Royal Commission on Transportation

Volume III

July 1962

Canada. Royal commission
on transportation
Report, vol. 3, 1962

1961

ROYAL COMMISSION ON TRANSPORTATION

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While authorizing the publication of these studies, which have been prepared at their request, the Commissioners do not necessarily accept responsibility for all the statements or opinions that may be found in them.

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1962

Price: $7.50 Cat. No. Z1-1959/3-3

Preface

During the course of the investigations of this Commission many special studies by interested groups were placed before us. These are part of the public record. In addition to the studies contained in the public record the Commission had special studies made in those areas where additional information seemed to be desirable and where certain evaluations had to be made with reference to submissions presented. The special studies which were found to be most significant in reaching conclusions respecting those problems for which we were given responsibility in our Terms of Reference are reproduced in this volume with the hope that they may be the basis of continued discussion and development by those public and private interests that are concerned with transportation in Canada.

A number of the studies make specific recommendations respecting the subject under consideration. Some of these the Report has embraced in recommendations, but there are some which, for a variety of reasons, the Commission was not prepared to accept. However, the studies as reproduced in this volume are as the individual authors submitted them and the Commission does not feel that it must bear any responsibility for those recommendations which are included in the studies which have not been incorporated into the recommendations to be found in Volumes I and II. The Commission requested the authors to permit the papers to be published as they were submitted, under their signatures, in order that the maximum reference material might be available for future consideration.

The Commission wishes to express its appreciation to the authors of these papers for their conscientious objectivity and integrity in their attempts to supplement the knowledge and information upon which the recommendations of this Commission rest.

The papers in this volume fall very broadly into three categories. The first two papers have to deal with the evidence and analysis of the increasingly competitive transportation industry. The next group of six papers attempts to develop the definitional concepts involved in the difficult technical problems of costing the movement of traffic in transportation and the analysis and statistical tools necessary to the application of these concepts. The third group of two papers deals with certain experience of transportation in other countries which we found useful in a general way when we came to measure the nature and extent of change occurring in the transportation environment in Canada.

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Truck-Rail Competition in Canada

Introduction

Overland freight transportation in Canada at the beginning of the 1960's was undergoing a major and rapid transition. Until a decade or two before this, the railways were accepted as dominant in overland hauling. Highway freight transportation had been growing steadily in Canada for several decades. But not until the 1950's did its growth show sufficient competitive strength to cause serious difficulties for the railways.

Up to that time, truck competition was confined largely to the area of short and medium distance hauls and its threat to the main volume of rail traffic gave little cause for concern. During the 1950's, however, trucks also began to compete more strongly for traffic on which it had previously been presumed the railways had an impregnable competitive advantage, namely, the long-haul or transcontinental transport. This indicated that the conditions of competitive advantage between rail and truck transport were in process of change and that previous assumptions would have to be revised.

To appraise these new competitive conditions, an examination of the commercial trucking industry was undertaken. In this examination, special attention was given to the recent growth and prospects of long-distance truck competition with the aim of identifying the particular techniques that had enabled truck competition to overcome its handicaps in this area.

The objective in the following report is, therefore, to examine the areas of truck-railway competition with a view to appraising its development, the directions it has taken and its future prospects. A further object was to explain the apparent paradox that although rail transport costs were reported to be substantially below highway costs,[1] the demand for highway freight services was growing at a much faster rate than rail freight services.

It was evident that the investigation of this cost paradox would require a deeper probing and more careful analysis of the unique nature of highway competition than had been done before. For this reason a special

[1] See, for example, J. C. Lessard, *Transportation in Canada,* a study prepared for the Royal Commission on Canada's Economic Prospects, Ottawa, 1956, p. 81, where the ton-mile cost is estimated to be by rail 1.5 cents and by highway 5 to 6 cents. In *The Economics of Competition in the Transportation Industries,* Meyer, *et al.*, Harvard, 1959, p. 194, the authors state: "A substantial share of the intercity truck traffic represents a higher cost of transportation to society than would rail transportation." The explanation of this paradox attributed by the authors to value of service ratemaking seems inadequate.

survey of trucking firms was undertaken, the first of its kind in Canada. Particular attention in this survey was given to organization, costs, areas of competitive advantage and the recent and prospective growth in demand for trucking services, especially in long-haul transport.

Along with this appraisal of comparative costs and services was included an examination of piggyback, containers and other recent developments in truck-railway competitive techniques.

The study was singularly successful in obtaining information needed to fill many of the important gaps in the knowledge of the trucking industry. It was focussed particularly on for-hire trucking, because this is the branch of the industry which competes most directly and strongly with rail freight transport. For-hire or common carrier trucking also carries the major share of total truck transport, more than the other three main types of trucking combined.

For-hire trucking in Canada is concerned primarily with intercity or highway transport. Such operations as it carries out within cities or other transportation centres are almost exclusively the pick-up and delivery (P & D) services incidental to its highway operations.

These P & D operations of common carrier trucking are a relatively small part of the total cartage services required within distributive centres. Most of these intracity transport services are carried out by local cartage firms, though not on a common carrier basis.

In addition to for-hire and local cartage trucking, there is private trucking. It is an alternative to for-hire service, much of it being intercity trucking. Some manufacturing and distributing firms find the nature of the trucking services they require such that they can be provided best by a leased or company-owned fleet of trucks.[1] Such private trucking is normally free of much of the regulation encountered by for-hire carriers and can be specifically directed to giving specialized service to the shipper's customers. It has grown rapidly in the past two decades.[2]

Contract trucking may also be noted here. In the main, however, it is an overlapping between private and for-hire trucking. Some truckers provide their facilities exclusively for the carriage of one shipper's goods—in effect,

[1] Some of the benefits attributed to private trucking are lower costs, better service to customers, more flexible service, better control over transportation, less loss and damage, better control of loading and unloading, less expensive packaging, advertising on trucks, merchandise received in better condition, faster delivery and service to off-line points.

[2] While major emphasis in this report is given to for-hire trucking, the growth in importance of private trucking is also a notable feature of highway transport development. Private trucking is significant also from the viewpoint of public policy. The great number of firms engaged in private trucking, many in only a small way, make its public regulation and control a difficult task. More significant perhaps is the facility of private trucking in providing an alternative service when common carrier services (rail or truck) become unsatisfactory or rates become excessively high. The rapid growth of private trucking in the face of handicaps (e.g., high empty returns) may indicate its importance in this role. See Appendix B, p. 93, for a summary of the survey of private trucking in Canada made by the Canadian Industrial Traffic League in the summer of 1961.

private trucking. Others may give priority to particular shippers but carry most traffic on a for-hire basis.

The fourth major type is farm trucking. In most provinces, farmers' trucks enjoy special licensing rates and more freedom from regulation, but the scope of their operations is correspondingly confined. In the main, farm trucking is limited to carrying farm products to market or hauling farm supplies or materials used in farming operations. As may be expected the utilization of farm truck capacity is relatively low and farm trucking provides a relatively small part of Canada's highway transport in terms of ton-miles hauled.

An indication of the relative importance of each of these four types of trucking in Canada is given by the percentage of total ton-miles performed by each in 1958:

For-hire	59.7
Private intercity	27.6
Private urban (mainly cartage)	9.9
Farm	2.8
	100.0

Considering only the intercity ton-miles carried by highway in 1958, for-hire trucking hauled 68.5 per cent. Like rail transport, it has become an intercity freight service. Unlike private intercity trucking, for-hire operators seek to compete directly with rail services for shippers' intercity traffic.

Growth of Truck Competition in Canada

The growth of for-hire trucking represents the extension of road transport from city cartage and private trucking into direct line haul competition by highway with common carrier railway services. This extension of trucking into the common carrier field has been a phenomenon mainly of the decades of the 1940's and 1950's. Its growth relative to railway services has been marked.

From 1938 to 1948 the number of railway freight cars increased from 168,329 to 172,406. By 1958 they had increased to 196,893 or 17 per cent over 1938. Truck registrations in the same period increased from 220,000 in 1938 to 488,000 in 1948, to 1,012,000 in 1958, almost a 500 per cent increase from 1938.[1]

DBS estimates of tons of intercity freight handled by rail and truck provide a second indication of the change in the freight transportation pattern. At five-year intervals these show:[2]

	Rail	*Highway*
	(thousands of tons)	
1942	155,646	130,194
1947	175,566	160,659
1952	185,056	226,364
1957	197,010	293,925

From 1942 to 1957 the railway share of Canada's total intercity freight tonnage (this includes rail, highway, water, air and pipeline) fell from 46.2 per cent to 30.7 per cent. In the same period, highway tonnage rose from 38.7 per cent to 45.7 per cent.

Tonnage alone is not a full measure of services performed. To measure production of transportation services most accurately it would be necessary to include both distance and time of hauls. Adequate records of time per ton hauled are not available but DBS has provided ton-mile estimates to take account of the distance factor. For comparable years, these estimates show the intercity ton-miles performed:

	Rail	*Highway*
	(millions of ton-miles)	
1942	56,154	2,424
1947	60,143	4,310
1952	68,430	8,903
1957	71,047	10,679
1959	67,957	13,900

---

[1] Truck registrations probably under-estimate the expansion of highway freight capacity. Ordinarily, one tractor represents 1.5 to 2 trailers. The rate of increase in trailers (more comparable to box cars) would be greater than in tractors since 1938. At the same time, truck registrations include a small proportion (less than 10 per cent) of ambulances and other non-freight vehicles.

[2] See G. A. Wagdin, *Statistics and the Study of Road Transport,* Ottawa, September 1959, Table 6. These data include freight traffic to and from U.S. points.

Rail freight traffic fell from 73.8 per cent of Canada's total freight ton-miles in 1942 to 53.8 per cent in 1957. Highway traffic rose from 3.2 per cent in 1942 to 8.1 per cent in 1957. By 1959 the rail share was 51.2 per cent and highway 10.5 per cent.

Comparison of the above table with the previous table on tonnages hauled shows two features of the competitive pattern. First, the average length of haul is very much greater by rail than by highway. Secondly, both length of haul and tonnage are increasing more rapidly for freight handled by highway than by rail. Between 1938 and 1957 it is estimated that railway ton-miles were multiplied two and a half times. In the same period highway ton-miles increased sevenfold.[1]

These ton-mile estimates tend to under-estimate the contribution of trucking because highway transport normally carries more of the higher valued traffic and includes more P & D services. The lower valued, low-revenue, bulk-handled commodities such as grain, lumber, ores and oil, are carried mainly by rail, water or pipeline. In 1958, for example, the average railway revenue per ton-mile was 1.55 cents but on the traffic for which trucks compete it was very much higher than this—on manufactured and miscellaneous commodities average ton-mile rail revenue was 2.75 cents, on animals and animal products 3.28 cents but on grains it was 0.70 cents and on mine products 1.35 cents.[2]

Similarly, trucks have concentrated more on the high-revenue L.C.L. traffic.[3] An indication of the recent effectiveness of this competition may be given by indexes of railway carloadings:

	Total revenue cars loaded	*Cars of merchandise L.C.L. loaded*
	(Index 1947	*= 100)*
1947	100.0	100.0
1952	105.2	88.7
1957	102.0	71.3
1960	91.9	46.6

In the period 1947 to 1957, the number of L.C.L. railway cars loaded decreased by 28.7 per cent and by 1960, 53.4 per cent. From 1957 on, part of this decrease represents a shift of L.C.L. to rail-owned piggyback equipment but an estimated 80 per cent or more apparently went to trucking firms. From 1947 to 1960 total railway cars loaded fell only about eight per cent, while cars loaded with L.C.L. were cut more than in half. This L.C.L. traffic also required a great deal more P & D services than most rail traffic. So to the extent L.C.L. freight shifted from railways to trucks the value of transport service lost was substantially greater than the shift in ton-miles would indicate.

[1] *Ibid.*, p. 9.
[2] *Waybill Analysis*, 1958, Ottawa, Board of Transport Commissioners.
[3] Unfortunately L.C.L. revenue is not shown in the Waybill Analysis.

This decline in railway L.C.L. traffic since 1947 supports other indications that the railways were finding it increasingly difficult to compete with trucks for such traffic in recent years.

The other important factor to be considered in railway-truck competition is the increase in the length of truck hauls. Speed and flexibility of truck services has given highway transport substantial advantages over rail services on short and some medium hauls, i.e., hauls up to about 500 miles. As a result truck transport has taken over an increasing volume of traffic in this area since the 1930's. More recently it began a rapid expansion in longer distance hauls, up to 3,000 miles or more.

Before examining the growth of trucking in these two fields, it may be desirable to define clearly what is meant by long-distance trucking. It has been convenient in the past to define long-distance trucking in terms of competitive costs, that is, distances beyond which highway operations are considered to be uneconomic. Thus Meyer, *et al.,* in their Harvard study suggest that hauls of 100 miles or more are too costly by truck and can be more economically done by rail.[1] Unfortunately, in most of these cases, the information on relative costs has been based on the trucking industry as a whole. For specialized long-haul trucking, these average industry costs may be very wide of the mark[2] because they overlook what the industry can do when it is concerned primarily with line-haul costs and with keeping them to lowest possible levels. In consequence, trucks continue to reach profitably beyond these calculated distance ranges in competition with rail service. So this type of definition has been progressively proven less and less sound.

A second definition is based on arbitrary distance groupings. The best known of these is found in the Gordon Commission study of 1956, "Today the greatest concentration of intercity motor truck activity is on routes between 20 and 600 miles in length. A great volume of motor carrier traffic also moves on routes up to 1,500 miles in length. But beyond that point there is considerable doubt as to whether or not line-haul motor carrier operations are profitable or practical". And later, "In 1956 the volume of transcontinental motor carrier freight traffic moving . . . over 1,500 miles has dwindled to a trickle".[3] This arbitrary classification may be interpreted

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[1] *The Economics of Competition in the Transportation Industries,* Cambridge, 1959, p. 189 and Table 39. The relative costs in this case included P & D costs for both modes of transport. Yet p. 195, Table 40, showed almost 98 per cent of common carrier trucking involved hauls of over 100 miles.

[2] Professor Currie recognizes this distinction to some extent. Compare "The combined terminal and line-haul costs on a ton-mile basis are lower for highway carriers than for rail up to the point where the cheaper terminal expenses of trucks spread over ton-miles are more than offset by the more favorable line-haul cost of rail carriers". *Economics of Canadian Transportation,* Toronto, 1959, (rev.), p. 488.

[3] A. F. Hailey, in *Transportation in Canada,* a report prepared for the Royal Commission on Canada's Economic Prospects by J. C. Lessard, Ottawa, 1956, p. 149-50, Appendix A. This was written at a time when long-haul trucking was going through one of its most difficult periods of development. See below.

to mean that long-distance trucking is in the 600 to 1,500 mile range and highway traffic beyond that is unlikely to be significant. This definition is inaccurate on several counts. The greatest concentration of intercity traffic is between terminals much closer together than 600 miles and hauls beyond 1,500 miles appear to be increasing and profitable.[1]

Trucking operations and costs have been changing too rapidly in the past two decades for such definitions as the above two, even if they were accurate, to remain valid for very long. A more useful description of long-haul trucking as it is now organized is *hauls beyond single driver range*. Single driver range marks a distinct boundary which encloses in the main all short- and medium-haul traffic. When more than one driver is required to move a shipment from origin to destination, it is appropriate to define the traffic as distinctly longer haul.

Single driver range is the maximum distance one driver can ordinarily cover in his day's work. This is a matter mainly of legal limits rather than endurance.[2] Overnight hauls are normally a single driver assignment. But a second driver is now regularly used on hauls where the continuous distance is beyond the usual maximum overnight run. In some cases, the second driver takes over the haul at an intermediate terminal. In others, the two drivers go all the way with the load.

Thus two types of long-distance trucking may be distinguished. First, and most common, is the long-haul operation that is broken into a series of single driver stages between intervening terminals. This type of operation is common in Central Canada and can be readily fitted in with short- and medium-haul trucking. Through-cargoes may be hauled 800 to 1,000 miles with drivers and tractors being changed at several intermediate stations. Interlining arrangements between two or more trucking firms are sometimes used to provide this type of long-haul service.

The second type is the specialized long-haul operation. In this case two drivers are regularly assigned to each road vehicle with the senior driver responsible for the whole trip. For these operations, drivers as well as equipment are particularly selected for their suitability. This kind of organization is found mainly where distances between terminals are longer than single driver range. This applies in the main to interregional traffic, for example, between Central Canada and Western Canada and, to a lesser extent, between Central Canada and the Maritimes or between Alberta and the Pacific Coast.

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[1] This is examined in detail below.

[2] Single driver range is now legally determined by the maximum number of hours of continuous driving permitted for one driver in the various provinces and states involved (usually 10 hours or less) and by permissible highway speed limits for trucks (commonly 50 mph and yielding an average road speed of from 30 to 45 mph). This would include short and medium hauls within the range of 400 to 450 miles for single driver operations. In the earlier years of long haul, single drivers were also used on the 2,500-mile hauls from Quebec-Ontario to the Prairies, with stopovers en route while the drivers slept. This technique apparently proved too costly and by 1960 had been largely discontinued.

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Major barriers of distance and topography separate these four regions. Until terminals spaced within single driver range become practical across these barriers a double-driver operation is apparently essential.[1] Under these circumstances continuous hauls may range from 600 miles to 2,500 miles or more, with the same drivers and tractors being used to carry the cargo from origin to destination.

Both of these types of long-haul trucking had become established in Canada by 1960. The first type, terminal-to-terminal single-driver long hauls, was a natural outgrowth of intercity trucking. As such, its growth during the 1930's and 1940's was not marked by substantially different trucking techniques from those of medium hauls. In the main, its development was confined to intra-regional operations, mostly in Central Canada and in related international traffic with the United States.

It was a more difficult problem to overcome the interregional terminal-to-terminal distances (and cost competition) between such points as Toronto and Winnipeg (1,400 miles), Toronto and Edmonton (2,600 miles) and Montreal and Moncton (600 miles). It will be one task of this study to examine how, and how well, these interregional distances and costs have been overcome by the specialized long-haul highway transport.

Growth of Short-Medium-Haul Trucking

Data is not available on the changing share of the short- and medium-haul freight traffic handled by the railways. But as early as 1950, the CPR stated that very little of its freight moved for less than 50 miles and not a large amount for less than 100 miles.[2] By 1960, experienced truckers indicated, over 75 per cent of the traffic within the 300- to 400-mile haul range was being moved by truck.

Information obtained in the survey of trucking firms showed that after a relatively slow growth in the 1920's and 1930's short- and medium-haul trucking expanded rapidly in the late 1940's and the 1950's. In addition the average-haul distances in which trucking played a dominant role were extended substantially during the 1950's. President S. P. Smith of Smith Transport Limited, the largest trucking firm in Canada, stated that, in the middle 1950's, the volume of this truck traffic was limited only by the number of road vehicles available.

Survey data from major for-hire trucking firms provided positive evidence of the rapid increase in short- and medium-haul trucking relative to railway freight operations during the 1950's. Comparison of the index

[1] Some long-distance operators attempted to establish such terminals during the development of highway freight services between Central and Western Canada but they were found unsatisfactory at that time.

[2] Royal Commission on Transportation, 1951, *Transcript of Evidence*, p. 15584.

of tonnages hauled by these truck operators with railway revenue carloadings and railway intercity ton-miles illustrates the substantial gains in recent years:

	Tons hauled by short and medium highway carriers	*Railway revenue carloadings*	*Railway intercity ton-miles*	*Index of industrial production*
		(Index 1953 = 100)		
1953	100.0	100.0	100.0	100.0
1954	105.1	92.5	88.2	99.6
1955	111.2	101.8	101.4	110.2
1956	116.1	110.3	120.7	120.0
1957	113.9	101.1	108.8	120.4
1958	121.4	94.5	101.7	118.2
1959	131.5	96.5	104.1	128.1
1960	n.a.	91.1	n.a.	129.8

From 1957 short-medium-haul truck tonnage continued to increase while rail carloadings fell substantially though industrial production climbed in both 1959 and 1960. At the same time railway ton-miles failed to drop as sharply as carloadings probably indicating that the proportion of long-haul rail traffic was increasing as trucking took over an increasing share of short-haul traffic.

These data indicate the tendency for growth of short- and medium-distance highway transport in relation to railway services. As suggested above, trucks have also been widening the haul range in this area of competition. It may be evident that this growth and widening of short-medium-haul transport, at least partly at the expense of railway traffic, must, if continued, eventually reduce some rail traffic densities to the point where the railways would have serious cost difficulties in maintaining services. There was substantial evidence in 1960 that the railways were already encountering these cost difficulties in numerous areas and that, if volume continued to decline, they would find it increasingly difficult to compete with trucks in this short- and medium-haul field in future years.

Growth of Long-Haul Trucking

In certain respects the growth of long-haul trucking has been even more significant than that of short and medium hauls. Its development has been more recent, mainly since 1950. It has grown in that area of overland transport where the railways had been presumed to have their greatest competitive advantage.

Since its development has been so recent, and the number of firms relatively few, it was possible to obtain much of the history of the growth of long-distance trucking in Canada. Because it marks a new and critical stage in truck-railway competition, the history of its development is examined

here in some detail to illustrate the nature of the new technology and the new competition that the railways have faced in recent years. In fact, this long-haul development may be used to illustrate the competitive techniques being utilized by truckers throughout Canada and may be useful in explaining much of the recent rapid expansion of shorter haul trucking noted above.

The history of long-haul trucking is quite brief, covering little more than a decade. Much of its story is found in the development of long-haul traffic between Central and Western Canada. It was apparently on these routes that the long-haul techniques were first perfected. These also involved much the longest of the interregional hauls and these distance handicaps along with other obstacles were most difficult to overcome there. For these reasons the Central-Western Canada development has been selected here as illustrative of specialized long haul in Canada.

Broadly speaking, the development of specialized long-haul trucking is the story of the expansion of payload to a competitive and profitable level. Major truckers state that there was an exploitable demand for trucking services between Central and Western Canada as early as 1945 if conditions had been suitable.[1] But up to about 1950 the highway transport environment was unsuitable for such traffic. Conditions of highways, road equipment and provincial and state regulations, in particular, combined to make trucking over these routes hazardous, difficult and unprofitable.

In the early post-war period, poor road conditions had made heavy East-West freight hauling difficult and costly. Highways were then structurally weak, relative to those later available in the 1950's, and this led most provinces and states to maintain low gross weight limitations. Truck licensing costs were high for such interprovincial traffic because little progress had been made among provinces and states in developing reciprocal licensing arrangements.

In this pre-1950 period, tractors and trailers were heavy relative to payload. Only gas-operated tractors were then available. They were low in power compared to the diesels that were later to come into use. Until the diesels came, major truckers stated, road equipment in Canada was not sufficiently sturdy and dependable for long-distance hauling. Highway tractors in particular did not have the power, strength, efficiency or reliability for these continuous hauls of up to 2,000 or 3,000 miles.

With these poor road conditions and the heavy, unreliable equipment, the potential payload was too small to make the profitability of such operations reasonably certain. In addition, long-distance trucking between Central and Western Canada had still to prove it could give competitive service in the for-hire field and, though demand for its services was growing, it had still to develop the traffic market.

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[1] Interview with S. P. Smith, president of Smith Transport, and others.

By 1950, these conditions had improved considerably and prospects for further improvements were favorable. By that time, United States No. 2 highway provided a paved East-West route through the northern border states. Good progress was being made in construction of the Trans-Canada highway. This offered the prospect of an all-Canadian route within a few years, though truckers were later disappointed in this.

In the late 1940's, wartime improvements in motive power, including diesel motors, were becoming available in highway tractors in the United States. These held out the possibility of improving the reliability of motor power for long hauls. They had a notable influence on long-distance highway transport when they were introduced in Canada in the early 1950's. This post-war period also marks the transition of truck manufacturing from its early role of mainly modifying passenger vehicles[1] to an industry specializing in highway freight equipment.

By 1950, the growth in demand for trucking services was becoming evident, particularly in the critical West to East traffic. Highway conditions and road equipment had improved. Rail freight rates had risen sufficiently on East-West traffic, as a result of successive horizontal rate increases, to make revenues attractive.[2] Conditions had improved enough for several for-hire trucking firms to consider pioneer development. In the spring of 1950 at least two firms inaugurated trucking operations between Alberta and Central Canada[3] and began to build up traffic.

Fortuitously, at this point, the August, 1950, rail strike occurred. This nine-day suspension of rail services created a pressing demand for extensive long-haul trucking services. Short-lived though it was, the strike was a notable test and demonstration for the trucking industry. It opened the door for an expansion of long-haul trucking that otherwise would probably have taken years to accomplish. It provided an opportunity to haul a wide range of traffic and to discover that trucking could compete at rail rates on much of it.[4] It demonstrated to shippers the special services that long-haul truckers could provide and their need to have those services available in such an emergency.

The 1950 strike also gave truckers the opportunity to test their abilities in overcoming the difficulties and obstacles of long hauls. To those

[1] See also Currie, p. 480.

[2] The application of the rate increases had made the rates between Central and Western Canada relatively more attractive to truckers than in other regions. This was because rates in Central Canada, being competitive with water rates, were not raised as much. In the case of Maritime traffic, with the MFRA subsidy not available to truckers, the rate increases were proportionately less attractive as far as trucking was concerned.

[3] M and P Transport began operations in April, 1950, Trans-Canada Highway Express in May of that year and Midland Superior in September. Several of these early long-haul operators had previous experience in serving northern Alberta and the Alaska highway.

[4] Trucking firms reported that revenues of $2,000 per truckload from Western to Central Canada were regularly obtained, giving a good margin of profit in spite of relatively high costs. For comparison such West to East traffic in 1960 was normally yielding only about $500 to $800 a load.

with the courage, experience and resourcefulness to meet these new obstacles, the strike and its aftermath was a unique chance to adapt their operations to the peculiar requirements of this type of transport. To those truckers with little enthusiasm for pioneering under these circumstances, it meant only a temporary period of extra traffic. For others who held on, but lacked experience and versatility it meant a gradual decline in profits that eventually forced them to abandon it. This weeding out of the long-haul truckers apparently continued for several years after the rail strike.

Meanwhile conditions were improving. Rapid progress was being made on the Trans-Canada highway. Other highways, strong enough to carry heavier freight loads, were being extended in both Western and Central Canada as well as in the border states. A few diesel tractors from the United States came into use. These were heavy but sturdy, built for the long periods of continuous operation required for these gruelling long hauls. Drivers were becoming more experienced in the responsibility and versatility needed for such operations. Rail rates, particularly those on L.T.L. and other class traffic that comprised much of the western movement, continued to rise.[1] Restrictions on mixing L.C.L. rail shipments to Western Canada made trucking revenues on L.T.L. particularly attractive. For the few trucking companies that were able to overcome the physical difficulties of these pioneer operations, traffic volume increased steadily and substantially. This has been attributed mainly to the widening recognition by shippers of the special services truckers could provide. More frequent deliveries that reduced inventories, less damage, the speed and flexibility of delivery, and delivery at consignee's door rather than to railway freight shed or team track, were some of the services noted. In addition, from 1950 on, some major shippers had hedged against future rail strikes by retaining truckers to carry at least a part of their regular shipments.

These favourable conditions of the early 1950's did not last. The next few years saw long-haul East-West trucking shaken to its foundations. Only the most efficient companies survived and even these were severely tested. The first blow was the foot-and-mouth disease which struck the Prairies in 1952 and wiped out the growing back haul in dressed meat traffic until March, 1953, when the United States ban was lifted. The second occurred in 1955 when the restrictions on mixing L.C.L. traffic to Western Canada were removed along with the equalization of freight rates, on March 1, 1955. The third was the intensification of competition from the railways in the later 1950's.

The change in the mixing rule cut deeply into revenues. Up to March, 1955, the mixing rule (designed to permit L.C.L. shipments to be mixed in

[1] The Board of Transport Commissioners authorized a 12 per cent horizontal increase in rail rates on July 4, 1951, later raised to 17 per cent, and further increases of 9 per cent on January 1, 1953, and 7 per cent on March 16, 1953. As noted above, these increases were more significant for trucking between Central and Western Canada than for other routes.

one car and so to obtain the lower carlot rate) as applied to shipments between Western and Eastern Canada was restricted to shipments going to people in the same line of trade, e.g., implement dealers, grocers, druggists, etc. To truckers this meant their substantial L.T.L. traffic, on which competitive rail rates were relatively high, could be depended upon for most, if not all, of their net revenues and profits.[1]

After equalization in March, 1955, the mixing rule for the West was brought into line with its application in Eastern Canada. The railways extended C.L. rates to mixed shipments on a much wider range of L.C.L. classes. As a result, many L.C.L. rates by rail were cut sharply. Truckers, continuing at their former L.T.L. rates, saw their traffic shift rapidly to the railways. There was no alternative but to follow suit. Trucking firms stated that their L.T.L. rates had to be cut 30 per cent on the average to compete with these new rail rates.[2] The effect on their profits was disastrous. Some did not survive. Those that did were forced to operate much more efficiently than they had before.

To compete under these new low L.T.L. rates they saw they must use bigger, more efficient equipment that would carry more payload. Fortunately, highways had improved sufficiently to make larger load limits permissible. Long-haul trucking shifted rapidly to big diesel tractor units and bigger trailers within the next several years. The transition was not easy. Financing new road equipment had always been difficult. It became a major challenge in this mass conversion to larger vehicles. Apparently only those who could finance a substantial conversion were able to survive. Some companies were merged or consolidated to form larger and competitively stronger firms.[3] A notable development of the mid-1950's was the increased investment of outside capital in the trucking industry in Canada. In several important instances this was used to consolidate established long-haul services with complementary short- and medium-haul operations.[4] This marked the recognition by the business world of the permanence of long-haul highway transport and a new confidence in its future prospects.

The outcome of this conversion and consolidation was a stronger, more stable industry and a substantial reduction in operating costs. With

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[1] L.T.L. freight is ordinarily used to "top off" T.L. or near T.L. shipments, thus utilizing any extra space and thereby adding enough high revenue traffic to make bulk T.L. shipments profitable.

[2] For example, the 2nd class L.T.L. rate quoted by one trucker fell from $6.73 a cwt. in 1953 to $4.81 in 1956. By 1960 it was $4.30.

[3] Various other techniques were adopted by long-haul operators to obtain capital in the 1950's. Some firms employed only those drivers who could finance the purchase of their own tractors. Others leased both tractors and trailers from individuals or trucking firms on a share-of-revenue basis. Starting in 1957, rail piggyback was used as a means of expanding. It required only the purchase of additional trailers.

[4] For example, in this period Soo Security and others were brought into the Canadian Motorways complex (a consolidation of some 52 trucking companies) and Gossett and Sons came into the Canada Steamship Lines organization.

the larger and more reliable diesel tractors, payloads increased while fuel costs were cut relative to the former gasoline tractors. Supporting these cost reductions were steadily improving highways and weight limits.

This period of conversion and consolidation, that enabled truckers to survive the 1955 reduction in L.T.L. rates and the other rate cuts and agreed charges which followed, appears to be an important milestone in the history of long-haul trucking in Canada. It marks a unique stage of determination, adaptability and constructive confidence on the part of the trucking industry that indicated long-distance hauling was sufficiently flexible and attractive to continue as a permanent component of Canada's national transportation organization.

This can perhaps be best illustrated by the history of its rapid growth in tonnage after the major setback of 1955. This growth is shown by the following index of tonnages hauled during these years. Compared to the growth indexes for short-medium trucking and the railways for the same period (above p. 11) long-haul growth between Central and Western Canada was substantial.[1]

	Index of tons hauled (1953 = 100)
1953	100.0
1954	140.1
1955	150.4
1956	183.3
1957	204.5
1958	275.5
1959	378.9
1960	403.5

This index of long-haul growth is based on the records of specialized long-haul firms. These were among the largest operators in the field. Their rate of growth in tonnage from 1955 to 1960 provides a notable achievement.

This growth was achieved in the face of greatly intensified competition from the railways. Trailer-on-flatcar (TOFC) service for rail-owned trailers, inaugurated in 1952, was an important early step in this competition. This was supplemented, in 1957, by opening TOFC service to for-hire highway carriers, at rates that appeared quite attractive on major routes (e.g., between Montreal and Toronto). It was widely believed that these apparently low line-haul rail rates would mean the end of long-haul highway transport between Central and Western Canada. But this rail competition through piggyback has been less effective than was expected, as will be shown below. Most long-haul truckers avoided its use except when it was to their particular advantage.

Piggyback competition was reinforced from 1955 on by the extension of agreed charges by the railways. As early as 1950, the CNR had

[1] Tonnage estimates for the indexes of long haul are based on data obtained from the survey of major trucking firms.

argued before the Royal Commission on Transportation that agreed charges were needed as a weapon to cope with truck competition.[1] By 1955, the railways had lost a considerable volume of the more remunerative types of traffic and had had to reduce rates sharply to compete with highway competition between Eastern and Western Canada.[2] In that year, Parliament approved the recommendations of the Turgeon Commission, permitting the extension of agreed charges without requiring approval of the Board of Transport Commissioners. From this time forward the railways used agreed charges with considerable effect as a competitive weapon. From 23 agreed charges in effect in early 1955, they were increased to 70 by the end of 1955 and by December 31, 1960, the number had reached 979.[3] An indication of their rate of growth is given by the number of tariffs on agreed charges filed with the Board of Transport Commissioners by the railways during those years (these include amendments and cancellations):[3]

1954	79
1955	176
1956	323
1957	547
1958	748
1959	1,004
1960	1,027

Increasingly these agreed charges were used to bind the long-haul traffic to the railways. Truckers involved reported that in the beginning, before they had diversified their operations, the impact of agreed charges on their operations was often devastating. This taught the long haulers to avoid becoming too dependent on one shipper or on one type of commodity. The resulting diversification blunted the sharp edge of the agreed charge weapon. In consequence, growth of long-haul trucking continued during this period at a rapid rate. It would undoubtedly have been much greater if the railways had not used this weapon so dexterously. Undoubtedly it protected for the railways a large volume of this traffic, though net revenues were apparently cut sharply to do it.

But long-haul trucking did not maintain its rate of growth without a major effort to meet this competition. It was necessary to continue, as in the past, to seek out larger and more efficient equipment and bigger payloads. During this period most of the remaining gas-operated tractors were replaced for the long haul by diesels. The heavy diesel equipment brought into use in the mid-1950's was in turn replaced, beginning about 1957-58, with new

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[1] At that time, only 23 agreed charges were in effect, all in the Prairie Provinces, Ontario and Quebec.

[2] See Report of the Royal Commission on Agreed Charges, 1955, p. 45.

[3] A special tabulation provided by the Board of Transport Commissioners. Since 1938, some 1,131 agreed charges have been filed, not including amendments. Of these, 152 had been cancelled up to the end of 1960.

lighter weight, lower cost[1] diesels. Performance and weight to payload had continued to be improved by truck manufacturers and the shift to these light weight, more powerful diesels[2] has been rapid since 1958. By late 1960 several major firms were completely equipped for their long-haul operations with these new 1959 and 1960 models.

Semi-trailers have been correspondingly enlarged. Truckers reported trailer dimensions had increased from a maximum of 6 feet by 6 feet by 28 feet (weight 10,500 lbs.) in 1953 to 7 by 7 by up to 42 feet (weight 10,800 to 14,700 lbs.) in 1960, virtually doubling their cubic capacity. Development of specialized and refrigerated trailers had also played an important part. These improvements increased the potential payload from an estimated 10 tons to 16-20 tons. From 1950 to 1960, round trip revenues, in spite of sharply reduced rates, were reported to have increased by more than 20 per cent.

But bigger payloads and correspondingly lower costs became possible only as highway load restrictions were eased. During the 1950's, provincial governments had recognized the role of long-haul trucking by raising weight limits as their highways improved[3] and by extending reciprocity arrangements with intervening provinces and states. Alberta took the lead in this and became a major centre for long-haul trucking between Eastern and Western Canada.[4]

Probably as a result of these improvements and of the increasing demand for long-haul highway services, trucking firms in this field reported continued rapid growth in traffic during 1960. This was in contrast to the information from short- and medium-haul truckers who indicated their traffic volume had, like rail freight, fallen off seriously in the latter half of 1960.

In summary, several factors appear to account for this rapid growth in long-haul trucking:

1. When it began in 1950, truck transport between Central and Western Canada was a relatively virgin field and a substantial initial demand was available for development and exploitation.
2. A substantial growth in demand for trucking services occurred throughout Canada during the 1950's.
3. In long-haul firms that survived the early long-haul difficulties,

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[1] Lower in operating costs.

[2] Rolls Royce, IHC, Kenworth, etc.

[3] The completion of highways 11 and 17 through northern Ontario was reported to have had little influence on the growth of long-haul operations. Except for cattle shipments from the West, most loads are routed over U.S. highways. Because cattle must be certified free of disease to pass U.S. customs, they are ordinarily routed on the all-Canadian route.

[4] The Government of Alberta was reported by long-haul operators to have assisted them in many ways to maintain trucking as a competitor for rail transport. It was noted, for example, that whenever rail competition by way of reduced rates or agreed charges became a very serious threat to the trucking industry, favorable consideration of higher highway load limits could be expected from the Alberta Government.

management appears to have been particularly energetic, able, versatile and determined.

4. These operators gave special attention to keeping costs low through using the most efficient road equipment, most careful selection of capable drivers, leasing of equipment, keeping terminal investment to a minimum, careful stowage, maximum payloads and minimum empty returns. Installation of teletype and telex services improved their control of traffic and the dependability of long-haul service.
5. They sought out profitable year-round traffic and adapted their transport, refrigeration and other services to meet better the needs of particular shippers.

Organization of Highway Transport

The basis for this growth of trucking in Canada may be found in its organization and in the specialized services it offers. In examining these features of the industry, the special survey of trucking firms provided much new information. The discussion in this section of the report is based, to a major extent, on the data obtained from the ten major trucking firms included in the survey.

The firms surveyed were all engaged in common carrier intercity transport. They handled approximately three per cent of the total tonnage hauled by for-hire carriers in Canada in 1959 and a somewhat larger share of the total ton-miles hauled.

Haul-Patterns

A substantial degree of specialization in route patterns was evident among these firms. The geographical location and pattern of haul routes varied from firm to firm and reflected in most cases the provincial franchises held by individual firms. But operators with the longest hauls tended to specialize in long-haul routes and this specialization applied also in shorter haul operations. The survey showed the following grouping of firms based on length of hauls:

Haul range	*No. of firms*	*Type*
1,200 to 2,600 miles	3	Specialized long haul
30 to 600 miles	3	Specialized short-medium haul
30 to 1,400 miles	4	Combined short to long hauls

The operators with the longest hauls were found to confine their activities to long-haul freighting almost exclusively. They solicited through-traffic moving over these long distances. Their local services were limited, in the main, to P & D services at route terminals. For traffic beyond this they had interlining arrangements with intra-provincial or other truckers.

On the other end were the specialized short-medium-haul firms. These aimed to provide an intensive, relatively complete service within a limited area. They estimated that 85 to 100 per cent of their hauls were overnight or less. These firms also depended on interlining with other firms to handle their traffic going beyond this restricted zone. In some cases this mutual interdependence was manifest in continuing arrangements between individual long- and short-medium-haul firms.[1] In others these specialized

[1] Special reduced rates (in some cases reduced by one rate class) were reported by some of these.

firms turned for interlining to whichever operator could give them the most satisfactory service and rates.

A third group of firms, engaged in short- to long-distance trucking, was attempting to meet both short- and long-haul demands of its customers. These firms reported 75 to 85 per cent of their hauls were overnight or less and under 500 miles. The operations of this group were concentrated mainly in Central Canada where the major volume of traffic lies. But they offered coast-to-coast services, though some of these were, in fact, by interlining or piggyback. More warehousing services, in addition to those related to highway movement, were provided by this group. It may be noted that except for specialized long-haul operations, for-hire trucking was organized primarily as an overnight service, with probably 90 per cent of it within overnight range.

Another aspect of the haul pattern relates to the major routes used by for-hire trucking in Canada. Much the largest movement of truck traffic in Canada is over the routes within the major industrial complex in Central Canada, centred from Montreal in the East to Toronto, Hamilton, Windsor and Sarnia in the West. The routes between Montreal and Toronto carried the biggest share of the traffic within this area.[1]

Fanning out from this central industrial hub are numerous distributive or feeder highway lines, the major international routes, and Trans-Canada and other long-haul routes.

The long-haul connections with Western Canada have been largely via United States routes through the border states. In recent years, an increasing share of this traffic has moved by the All-Canada route through northern Ontario. All-Canada routing of long-haul traffic should increase greatly when the Trans-Canada highway is completed.

In the main, route patterns of for-hire trucking in most provinces emphasized intra-provincial transport services. This was no doubt the result of trucking franchises and highway construction being primarily in provincial hands. The development of long-haul trucking between Central and Western Canada depended, perhaps more than is generally realized, on the use of U.S. highways and the freedom of entry of new trucking firms in the Province of Alberta. Ontario, situated in the centre of the Trans-Canada route and with much the longest section of the highway to provide, has been marked by gaps at both ends of the highway freight route. Closing these critical gaps, expected by 1962 or 1963, is likely to shift substantial Canadian traffic from U.S. routes and from piggyback.

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[1] Since 1957, incomplete or inadequate highway facilities between these two centres had encouraged a major shift of for-hire trailers from the highway to railway piggyback services, though most trucking firms continued to send a substantial share of their trailers by highway. Over 200 trailers a night each way between Montreal and Toronto were reported moving by piggyback in 1960. Most of these were owned by for-hire trucking firms. But most of the firms in the survey that used this piggyback service reported that they would return in the main to highway service when highway facilities were improved.

Contract Versus For-hire

The ten major trucking firms in the survey reported their operations were almost exclusively on a for-hire basis. A few firms hauled from one to three per cent of their freight on a contract basis. Indications were, however, that considerably more traffic than this was handled on a near-contract basis. In other words, individual truckers had adapted their services so effectively to particular shippers' requirements that such shippers did not seek alternative carriers. This specialization of service to particular shippers was indicated to be a major competitive advantage of trucking over the more generalized services of the railways.

Intra- and Extra-Provincial Services

Specialized long-haul operators limited their activities almost exclusively to interprovincial traffic, with a small share (about one to five per cent) in international traffic. Their intra-provincial service was mainly confined to the P & D services required for their long-haul operations.

For specialized short-medium-haul firms, on the other hand, over 60 per cent of their operations were in intra-provincial services with the remaining nearly 40 per cent usually concentrated either in interprovincial (chiefly Ontario-Quebec) or international services.

Operations of the short- to long-haul firms varied, with emphasis in some cases mainly on interprovincial traffic and in others on intra-provincial, with a substantial volume of Canada-United States traffic in most instances.

Much, probably most, of the international traffic was handled by Canadian trucking firms through their United States subsidiaries. Some was handled under agreement with independent U.S. truckers.

Long-haul operators had until recently confined their international traffic mainly to making small drop-offs on their regular interprovincial routes through the U.S. But development, in the late 1950's, of direct hauls of fresh fish and other products from Western Canada to Chicago, Detroit and other U.S. markets, as well as traffic from Central Canada to the southern States, indicated that long-haul international traffic was expanding.

For-hire Truck Traffic

Most descriptive of the role of for-hire trucking in its competition for traffic with rail transport was the statement of a senior official of a trucking firm who had spent most of his life in the industry. "Trucking", he said, "fits in where it can".

Thus, generally speaking, trucking operators indicated they sought out the most profitable traffic but stood ready also to carry much that yielded

relatively low net revenues. It was possible for them to operate successfully on this basis, in some cases, by judiciously combining the high revenue traffic with the low; in others, by cutting their costs or increasing payload, or both, to enable them to carry low revenue traffic profitably. By these techniques, the for-hire trucking industry, while it had not reached into iron ore or the wheat traffic in its competition with rail services, was making profitable bulk hauls of mineral concentrates, steel rods and sheets, and such, some of which were being hauled up to 2,500 miles. Overall, the evidence indicated that for-hire truckers were steadily finding new avenues for reaching more widely and deeply into Canada's freight traffic.

In broad terms, their traffic pattern, by the early 1960's, had been strongly influenced by:

1. The railway rate structure which, with its elements of value-of-service ratemaking, horizontal rate increases and other institutions, had over previous years made rates in certain areas and in certain traffic classes particularly attractive for truck competition. But rate adjustments in the 1950's (rate equalization, agreed charges, etc.) had substantially reduced the profit opportunities in many of these areas by the early 1960's.
2. A notable growth in demand for more specialized and individualized transport services than the generalized service of the railways could provide. Factors stimulating this demand were the decentralization of industry and distribution; the increase in manufactured, processed and perishable products and the related increase in volume of high-rated traffic; the increase in demand for smaller and more frequent deliveries to hold down inventory costs; and the increased demand for specialized services, such as refrigeration, tankers, etc.
3. The speed, economy and flexibility of highway transport in providing these specialized services, in handling L.T.L. traffic, and in adapting its services to unique shipper requirements.
4. Some narrowing of the gap between railway and truck line-haul costs due to technically improved highways and road and handling equipment as well as more efficient trucking organization.

The result of these influences operating over the past decade or two has been a widening and diversification of the traffic being profitably hauled by highway. The short-medium-haul truckers, because of their advantages in speed and economy in P & D and in short-haul operations, had of course a much wider range of traffic than long-haul firms. Yet the long-distance operators reported having a demand for as much profitable westbound traffic as

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they could handle. But profitable eastbound traffic had been less readily available to them and required more careful selection and development of special services, particularly in refrigeration of meats, fish and other perishables. By 1960, however, there was evidence that development of eastbound traffic had been successful enough to require some promotion of westbound traffic to complement it.

In general, truckers had, by this time, found it unwise to specialize too much in one particular type of traffic. If they became too specialized, their experience had shown, the risk of losing most of their traffic as a result of the railways, or another trucker, offering lower rates was too great. This risk was reduced by diversification of traffic and most trucking firms, especially in long haul, had adopted diversification as survival insurance.

The traffic pattern found in the survey of trucking firms illustrates these factors. Highway trucking services were noted for their speed and dispatch, relative to other modes of transport, in handling small freight shipments. This no doubt accounts for the large proportion of L.T.L. in for-hire traffic. By weight, L.T.L. shipments were reported to average from about 30 to as high as 56 per cent of total traffic. But in number of shipments (which governs the amount of handling), L.T.L. was 80 to 99 per cent. On the basis of revenue, L.T.L. was between these two.[1]

The relative proportions of L.T.L. traffic by weight, shipments and revenue varied substantially among firms. Even within each of the three types of firms noted above there were significant differences. Most firms reported their L.T.L. was a relatively constant proportion of total traffic (by weight, shipments and revenue) but some handled a much larger proportion of near-truckload shipments than others. Others handled mainly small shipments.

Traffic originating in Central Canada had in the main a larger L.T.L. component than traffic moving from Western Canada to the East. Long-haul operators reported their eastbound traffic was mainly truckload with L.T.L. averaging about 30 per cent or less. Their westbound traffic (i.e., mainly from Ontario and Quebec) averaged 70 per cent L.T.L. by weight.

For firms with operations concentrated in Central Canada, L.T.L. was estimated to range from 30 per cent of total traffic to 55 to 60 per cent.

L.T.L. was regularly used by long-haul operators on westbound trips to "top-off" the near-truckload shipments, with the object of adding enough of the higher-revenue L.T.L. to make each round-trip profitable.

With the lesser volume of L.T.L. eastbound, these long-haul operators had to depend mainly on the limited range of truckload or near-truckload

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[1] For example, several samplings indicated that when L.T.L. was 30 per cent by weight it might average as high as 95 per cent by number of shipments and 45 to 50 per cent of the revenue.

traffic that would yield sufficient net revenue in itself. This tended to confine eastbound traffic to higher-revenue, year-round traffic or to traffic on which trucks could give superior service and thus obtain higher rates than the railways. Accordingly, most long-haul operators reported their operations were restricted mainly by the limited availability of suitable eastbound traffic. They could fairly readily obtain more profitable westbound traffic than they could handle.

The eastbound traffic that had been found most satisfactory for these long-haul truck operations were certain chemicals including polyethylene; dressed, frozen and canned meats; fresh and frozen fish; cattle and to a lesser extent hogs; dressed poultry; cheese; honey; liquor; military supplies; repairable tires;[1] seeds; scrap metal and such. Butter and eggs had been carried but their seasonality made them unsatisfactory.

A growing traffic in livestock (mainly cattle and hogs) had been developed, starting about 1958, as a year-round operation. This began only after the Trans-Canada highway through northern Ontario was opened in the mid-1950's.[2] Prospects that load limits would be raised, particularly through Saskatchewan,[3] had also stimulated these livestock shipments. With the completion of paving on the Ontario sections of Trans-Canada highway[4] and highway load limits all raised to 70,000 or 72,000 pounds, livestock was expected to become a major component of eastbound traffic for these long-haul operators.

On their westbound movements, traffic was generally similar to that handled in Central Canada. It included a wide range of manufactured and miscellaneous goods, much of which moved at relatively high rates. At the same time, it included an increasing volume of bulk traffic (steel, aluminum, lead and nickel concentrates, plywood, scrap metal, concrete pipe, asbestos and even stone) all carried at relatively low rates by truck.

Long-haul operators, like their counterparts on short and medium hauls, had developed a substantial part of their traffic on the basis of specialized services for a particular commodity or shipper. They had adapted road equipment, refrigeration or air conditioning, P & D, highway time and other services to the special requirements of shippers of such commodities as dressed beef, pork cuts, fish, livestock and frozen foods. Such specialization had been developed mainly for eastbound traffic. Because of the diversity of traffic in westbound loads, the possibility for specialization was more limited. But opportunities for such specialization were expected to grow as

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[1] Tire companies usually require that their shipments travel by highway.

[2] For livestock, the costs and delays for health inspection and certification at the U.S. border made its movement by U.S. routes unprofitable.

[3] Maximum weight in Saskatchewan was raised to 72,000 pounds on April 1, 1961.

[4] Paving on Ontario Highway 11 was expected to be completed in 1961 and on Highway 17, the shorter route, by 1962 or 1963.

westbound traffic increased. The techniques for it had already been worked out by short- and medium-haul truckers who were providing specialized services for chemicals, flour, etc., by tanker, for auto components, L.T.L., magazines and many other goods.

This specialized flexibility of trucking service has enabled operators to build up substantial volumes of traffic that were, to a considerable extent, tied to the individual trucking firm. Because railways were more limited in such adaptability, this constituted a major competitive advantage of trucking over railway service.

Speeds, Loads and Empty Returns

Speed of delivery has become a critical factor in service to shippers. Accordingly, it has become an important element in railway-truck competition. On short hauls, trucks have a substantial advantage because of the extra time required by rail in loading and unloading the freight in box cars or by piggyback, in switching, and such. On longer hauls, the effects of these railway time losses are reduced by spreading them over more miles, but other delays en route (switching at intervening stations, passing through hump yards, etc.) add to the time required for delivery.

Trucks, each operating as a single unit, avoided much of these delays by being fully loaded at origin with freight for a single destination, so stops en route were unnecessary except for refuelling and such. Railways could duplicate these conditions by loading full trainloads for a single terminal destination but they were limited in how far they could go in this. Extra costs and extra time at the dispatching terminal and considerable reorganization of dispatching and sorting techniques would be required to extend it farther. The CNR "highball" service between Eastern and Western Canada, announced early in 1961, was designed to overcome some of these obstacles.

Freight train speeds are regulated on the basis of track and roadbed conditions. The result is that while maximum rail speeds may under the best track conditions exceed maximum highway truck speeds, the average maximum by rail is about the same as by truck. And average line-haul rail speeds (20 mph in 1960)[1] were well below the average for trucks.

The data obtained from trucking firms indicated that highway speeds for long-haul operations were only slightly higher than for short-medium operations. Estimates of average road speeds varied from 30 to 45 mph but calculations based on trip times showed the average for all ten firms to be close to 35 mph with long haul at 37 to 38 mph.

Long-haul truckers reported they regularly gave fourth-morning

[1] See CNR and CPR annual reports.

delivery between Calgary-Edmonton and Toronto-Montreal, while their shippers indicated the best the railway could offer was fifth-morning delivery, even with piggyback.[1] Rail speeds, while moving between East and West might be as high or higher than truck speeds, but the railways lost time in having to fit shipments into more inflexible dispatch schedules, in switching and classifying at Winnipeg, in stopping for inspection of bearings[2] and in P & D at origin and destination. It was expected that the railways' improvements in hump yards, switching, train scheduling, etc., would within a year or two enable them to provide fourth-morning delivery also. By that time, however, trucking firms expected the Trans-Canada highway would be completed thus permitting them to give third-morning delivery.[3]

By the same token, long-haul trucking had advantages over short-haul in relative speed of delivery. In addition to faster highway speeds these long-haul advantages included fewer turn-arounds, relatively fewer P & D operations and more of the transit time devoted to hauling on the highway.

Even more significant for costs were the size of payloads and the proportion of empty returns. Long-haul trucking was distinguished by heavier and more careful loading and less empty returns than short-medium haul operations. For long haul, loading as closely as possible to maximum capacity and load limits was apparently one of the most critical factors in holding trucking costs low enough to compete with rail services. In effect, this meant that trailers must be fully loaded both ways and westbound loads must be balanced with eastbound loads.

Ordinarily westbound loads were limited by the number of profitable eastbound loads that were available to balance the traffic. Nevertheless, westbound loads required more careful stowage in the trailer to ensure that each vehicle carried as full a load as possible, that each load had sufficient complement of L.T.L. to make each trip profitable,[4] and that each shipment would withstand the long trip without damage.

The nature of the eastbound long-haul traffic made it less adaptable to maximum-revenue loading than the westbound. There was more wasted space (e.g., in loads of hanging meat), more tare due to refrigerated trailers, less weight per cube, and less L.T.L. Thus, in 1960, eastbound loads (on 5-axle units) were averaging about 12 to 13 tons, while westbound loads

[1] This was before the "highball" service was inaugurated.

[2] Board of Transport Commissioners officials estimate freight trains stop approximately every 75 miles on the average for inspection of wheel bearings on the whole train.

[3] Trans-Canada route from Toronto to Edmonton when completed will be less than its 2,300 miles in 1960. This should enable the trip to be made in 65 hours or less.

[4] Profitability in long-haul trucking was viewed in terms of the round trip, with the higher revenue westbound loads being used to compensate for the lower revenue eastbound loads. This balancing of revenue was particularly desirable in the case of leased equipment as a means of ensuring that each driver received an adequate minimum return for his trip. Average revenue per load in 1959-60 was running at about $1,300 westbound and $900 eastbound or $2,200 round trip.

averaged 16 tons.[1] A significant upward trend in payload was noted. From 1955 to 1960, westbound loads increased by 3,000 pounds on the average. A substantial increase was evident in eastbound loads but some operators showed much larger increases than others, depending on the type of traffic hauled. But the shift from 4-axle to 5-axle units during this period apparently enabled long-haul loads, both ways, to be pushed up by an average of 1½ to 2½ tons.

In contrast, highway loads carried by short- and medium-haul operators averaged slightly over 10 tons while their piggyback loads averaged close to 15 tons. Load weights varied over a much wider range in short-medium hauls. This was partly because cost-revenue considerations permitted more unused capacity and partly because of wider variation in size of equipment used. More 3-axle and 4-axle equipment was used on the shorter hauls. Several samples indicated that, on the average, loading for low-density and high-density areas of short-medium haul traffic for the three equipment sizes might run approximately as follows:

	Average low-density loads (tons)	*Average high-density loads (tons)*
3-axle	3.0	10.5
4-axle	6.0	12.0
5-axle	8.0	17.0

It was notable, however, that some very large payloads were carried in short-medium hauling, larger than in long-haul operations. Loads up to 20 tons or more were made possible by using light-weight (stake) trailers. There was a wider range of profitable dry freight in Central Canada suitable for these heavy operations. On long-haul operations, on the other hand, with the nature of the eastbound freight commonly requiring refrigerated trailers, the extra weight in cooling unit, insulation, and heavier construction was reported to reduce the payload potential by several tons relative to dry freight traffic.

A substantially lower proportion of empty returns in long-haul operations can be attributed mainly to the greater emphasis given to balancing westbound with eastbound loads and to careful stowage to ensure maximum loading. By these techniques it was possible to keep unused capacity to a relatively low level and thereby maximize revenues per unit of equipment. Empty returns, which measure unused truck capacity, were held between 2 and 10 per cent of total volume in long-haul operations. Short-medium

[1] Trailer loads shipped by these long-haul truckers via piggyback averaged about three tons heavier than highway loads.

haul trucking, on the other hand, averaged 20 to 30 per cent empty return. Railway freight services averaged about 35 per cent empty return overall in 1960.[1]

Investment

Capital investment in freight transportation is relatively high in proportion to output when compared with most industries. For the trucking firms surveyed the ratio of investment to value of output was estimated at 1:1.5. For long-haul firms it was 1:1.3. Annual reports of the two major railways showed investment to be a larger proportion of output than these. But total railway investment includes a large proportion of roadbed in which trucking does not invest directly. A more useful comparison may be the ratio between equipment investment and output.

Road Equipment

Trucking, like inland water freighting, had most of its investment in hauling equipment. Out of the total investment of almost $57 million for the 10 major trucking firms surveyed almost 79 per cent was in road freight equipment. For long-haul firms alone the proportion was 77 per cent.

The ratio of investment in road equipment to output for all these trucking firms was estimated 1:2. For the railways, estimates based on their annual reports, indicated the ratio of 1:0.7 for depreciated equipment investment to railway revenue.[2]

The ten trucking firms surveyed had a total of over 8,700 road vehicles including tractors, trailers and single-unit trucks.[3] In the main, tractors and trailers were used for the highway operations while single units took care of P & D (particularly L.T.L.) services. But where the P or D involved a substantial part of the load, tractor-trailer units were commonly used for this to avoid rehandling. Similarly, single-unit trucks were used to some extent for short-haul highway operations.

Trailer numbers were double those of tractors. Extra trailers were required for stationing at the terminal or shipper's docks for loading or unloading while the tractor was in use elsewhere. But major firms indicated that 1.5 trailers per tractor was the normal requirement. Indications were

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[1] Annual reports CNR and CPR, 1960.

[2] This ratio might be slightly higher if passenger services were excluded but passenger equipment and revenues are a relatively small proportion of those for freight. In 1960 railway passenger revenue was about seven per cent of freight revenue.

[3] These comprised 2,442 tractors, 4,870 trailers and 1,407 trucks.

that many firms retained their old trailers after more modern ones were purchased, partly for a reserve for peak periods and partly because their sale price was relatively low.[1]

The equipment used by specialized long-haul firms was distinguished by being larger, newer and costlier on the average than the equipment of short-medium-haul firms. For highway operations, long-haul firms specialized more in heavy, powerful tractor-trailer units with more (in fact, most) trailers equipped for refrigeration. These standard long-haul highway units were supplemented by a few stake trailers, trucks and service cars. Less P & D equipment was required in long haul, because P & D was a smaller proportion of total operations and because trailers were more often fully loaded at one shipper's dock (especially in the West) than was the case for short-medium operations.

Long-haul tractor fleets were newer, the average age ranging from one to three years against over five years for the other firms. From 1957 to 1960, long-haul operators had modernized virtually all of their fleets of tractors and trailers. Their records at the end of 1960 showed their equipment to be sturdier, larger and more modern and efficient than it had been in previous years. They appeared better equipped to compete in costs, speed and service under the difficult long-haul conditions than they had ever been.

The average investment in each tractor and trailer provides an indication of how far these long-haul firms have gone in obtaining the capacity, efficiency and advanced techniques they require to meet cost, speed and service competition under the difficult conditions of long-distance trucking. The average depreciated value of tractors and trailers for the long haul and for other trucking firms in the survey illustrates this:

	Long haul	*Other firms*
Tractors	$20,000	$9,000
Trailers	11,000	6,000

The utilization of equipment has become a major determinant of hauling costs. This is because of the high investment in road equipment relative to output, the trend to newer, costlier and more efficient equipment and the increasing importance in operating costs of depreciation, obsolescence and maintenance that result from these.

Utilization of equipment can be most effectively measured in ton-miles hauled during a given period. In this survey, because ton-mile records were not available from most firms it was necessary to depend on miles hauled.[2]

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[1] A small proportion of the extra trailers were attributed to piggyback requirements. In addition, short-medium-haul firms gave more emphasis to the full demands for service during peak loads than long-haul firms were able to do.

[2] Miles hauled can be converted to approximate ton-miles by multiplying by the average load in tons—in the case of long-haul trucking, about 14 tons; for short-medium hauling, about 10 tons.

A substantial advantage was gained in utilization of equipment by the more continuous highway operations of long-haul firms. This is illustrated by the average miles hauled per tractor for the three groups of operators in 1959.[1]

Specialized long haul	110,000 miles
Short-medium haul	35,000 miles
Combined short to long haul	48,000 miles

The advantages of this greater utilization were substantial. In addition to reducing investment costs (depreciation, interest, etc.) per mile, it cut down average repair and maintenance costs per unit of traffic. At the same time, it enabled motive power to be sufficiently depreciated, within about five years, so it could then be replaced with new, more efficient equipment with little if any loss in investment on the old.

In spite of its higher utilization, however, this large investment in large-scale, modern road equipment was reported to have been the source of serious difficulties in financing. Long-haul firms reported that regular commercial credit agencies considered the financing risk too great[2] and funds that were available could be obtained only at relatively high interest rates. In the beginning, credit had been obtained mainly from private sources and auto finance companies, the latter at reportedly high interest. These sources were said to be inadequate for the capital required for expansion and long-haul operators stated this had been a most difficult and continuing problem.

The evidence showed, however, that these financing problems were related not only to the large amounts of capital required for road equipment but also to the extent to which management had demonstrated its ability to organize profitable trucking operations. Financing equipment was only one of the major problems faced by trucking firms in their early development. Perhaps equally important were the problems of obtaining competent, dependable drivers and sufficient, profitable traffic.

For some long-haul firms the twin problems of financing and competent drivers had a common solution, driver-ownership. This applied particularly to tractors. Over 85 per cent of the tractors used in long-haul operations were, in effect, leased from driver-owners.[3] Only 25 per cent of the trailers were so leased.

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[1] These data tend to under-estimate the tractor utilization of long-haul operators relative to the other two groups. Larger loads and less empty returns would increase the relative use for long haul in terms of ton-miles. In addition, for the last two groups, the miles *per tractor* includes the miles hauled by single unit trucks.

[2] The risk in his case was related not only to the high investment relative to output but also to the possible losses to vehicles through accidents or careless driving and servicing as well as untested capabilities of management in newly established firms.

[3] In the main, these lessors were two-man partnerships or small firms organized primarily to provide tractors and drivers. But their equipment was usually purchased according to the specifications of the lessee.

Leasing of equipment, while more prevalent in long-haul firms, was also found in short-medium operations. In the latter case, however, road equipment was leased mainly from specialized lease-financing firms and the trucking firms supplied the drivers.

Such leasing was reported as necessary to enable companies to expand while maintaining adequate operating capital. It was most significant in the growth of new firms. In addition, longer established firms reported that leasing permitted them to shift part of their big financing burden to a specialized agency and thus reduce their own administrative task.

At the same time, most firms using leased equipment indicated their aim was eventually to own all the equipment they used in order to control their operations more effectively. There were indications this had led some firms to seek investment capital for their expansion. In most firms that had succeeded in obtaining such outside financing, the equipment was owned.

Terminals and Other Facilities

Trucking operations were usually centred around the head office terminal of the firms with branch terminals located on routes at convenient points for P & D and trans-shipments. The head office was most commonly situated at the point where most of the traffic was handled. Here, in addition to the main terminal, with its dock and handling equipment were usually located a fully equipped repair garage well stocked with spare engines and parts; a fuel and lubrication service with a substantial inventory; administration, accounting and dispatching offices as well as the necessary personnel to man these facilities.

Investment in terminals and other facilities was a relatively small proportion of total investment, except for firms carrying on warehousing operations in addition to those related to trucking.[1] Terminal investment attributable only to trucking was about 15 per cent of total investment for all firms surveyed. For specialized long-haul firms it was 20 per cent and for other firms it was 14 per cent. This difference in percentage needs to be considered in relation to the traffic hauled. Terminal investment per ton-mile hauled was estimated at 0.5 cents for long-haul firms and 0.64 cents for the other firms. Long-haul firms required significantly less warehouse services per ton-mile because a larger proportion of their operations were in the highway movement.

For many firms the growth of traffic during the latter 1950's had begun to tax their warehouse and handling capacity. This applied particularly to those firms handling a large proportion of L.T.L. Long-haul firms were

[1] In the main, only the larger firms had special warehousing operations in addition to those for direct handling of truck traffic.

finding this less of a problem than the shorter haul operators. Nevertheless, firms of both types had been occupied in building new warehouses and in improving their dock and P & D handling efficiency.

With the growth in cross-dock handling of L.T.L., accompanied by increased dock wage rates, techniques for mechanizing warehouse operations had received much attention. Various materials-handling techniques (fork-lifts, overhead loading, "merry-go-rounds", and conveyor systems) were being used to reduce dock labour costs. Taking the industry as a whole, it was evident that though it had gone further than the railways in increasing L.T.L. efficiency there was still room for much improvement in this area. Even those firms that had adopted the most modern handling techniques were aware that further improvements could be made. But the trucking industry, lacking a central research agency and with few firms willing or able themselves to carry out the studies and costings necessary, had left the testing of these new handling techniques to individual firms mainly on a trial and error basis.

Better results were being obtained in improving the efficiency of P & D operations. Some of these improvements were the result of the research being provided by trailer manufacturers such as the two-part trailers that permit one section to be dropped off at an intervening station or shipper's warehouse in a matter of few minutes. Others, like the fish nets used in trailers to separate L.T.L. drop-offs for each point between terminals, were the result of common-sense planning by trucking companies themselves. These techniques enabled all L.T.L. to be sorted at the terminals for each destination thus reducing delays en route and concentrating the sorting operations at the points where maximum specialization and supervision can be used to promote efficiency and reduce handling costs.

Labour and Wages

Labour played a most critical role in the success of for-hire trucking. Labour was a major element in total costs of trucking—wages and salaries together averaged about 40 per cent of total expenditures. In addition, trucking firms looked upon each driver, while he was on highway or P & D duties, as individually responsible for the safety and successful operation of his highway vehicle and for much of the good-will and patronage his firm enjoyed. The high standards and special abilities required in long-haul highway drivers were particularly noted.

Drivers made up over 44 per cent of the total workers in for-hire firms. But in the case of short-medium-haul operators, most of these, 64 per cent of all drivers, were engaged in P & D while their highway drivers comprised 36 per cent. In long haul, most were engaged in highway operations, P & D required only about 20 per cent of the drivers.

Workers other than drivers comprised about 56 per cent of the labour. These included dock labour, maintenance men, terminal office staff, salesmen, and other workers.

In most of the short- to medium-haul firms the workers were organized under a standard union contract covering wage rates, benefits and working rules. But in specialized long-haul firms, labour was not organized.

One major reason for this was that so many long-haul drivers owned the equipment they operated (or part of it) and were paid by a percentage of revenue rather than wages. Another factor was that long-haul drivers received relatively high remuneration, whether on share or mileage basis, and union organization raised the possibility their returns might be reduced to the level of shorter haul drivers.

Highway drivers were normally paid on a mileage basis while P & D drivers and other workers received an hourly wage. In Ontario, the highway rate was 6.3 cents a mile in 1960[1] under the union contract. The maximum day's run was about 320 miles or 10 hours driving and the average driver earned about $100 a week. In Quebec the rate was lower, 5.3 cents a mile for regular routes.

P & D drivers received $1.56 to $1.62 an hour in Ontario in 1960 and in Quebec $1.46 an hour. Fringe benefits (health and welfare, etc.) were additional to these rates for all drivers.

In long haul, with two drivers to each vehicle, senior drivers were receiving from 4.25 to 4.8 cents a mile and second drivers from 3.5 to 4.5 cents a mile. Both were paid these rates for the full return mileage. Drivers averaged three trips a month (normally a week per trip with one week a month off) giving them returns of $600 to $700 a month. In some cases, bonuses were paid, in addition to this, for accident-free delivery of the load in good condition to the consignee.

Leasing arrangements for owner-operated highway equipment were almost all on a share-of-revenue basis—84 to 85 per cent to the owner-driver and the balance to the trucking firm.[2] The driver was then responsible for all his operating expenses and, in some cases, a share of various terminal expenses (P & D, insurance, etc.) directly related to his loads. The trucking firm's 15 to 16 per cent share covered terminal and overhead costs including headquarters and branch staff, dock wages, etc., and profits.

Leasing seems to have been a natural outgrowth of the conditions of long-haul trucking. The length of the non-stop hauls and difficulties of communication made it impossible to provide from headquarters the super-

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[1] This rate went up to 6.45 cents (2-axle) and 6.5 cents (4-axle) on January 1, 1961.

[2] In some cases, this 84 to 85 per cent included rental of both tractor and trailer. In others, it covered only the tractor with the trucking firm providing the trailer—this was commonly found where special refrigeration or other trailer equipment was required. In addition to such highway equipment leasing, some P & D road equipment was rented but this was ordinarily on an hourly basis—driver and vehicle cost about $3.00 an hour.

vision and direction of truck operations that are found necessary on short-medium operations. As a result the initiative, judgement and decisions relating to the handling en route of valuable equipment and cargo had to be left to the responsible driver to a considerable degree. This made the careful selection and screening of suitable drivers a most critical factor in successful long-haul operations.

Some firms had been able to screen successfully enough to find drivers that were competent to operate company-owned equipment. Others had turned to leasing as an aid in such selection. The latter had found that drivers who owned their own equipment usually showed above-average initiative and responsibility. In addition, having a monetary interest in avoiding accidents or damage losses provided them with an incentive for careful handling of equipment and cargo.

In short, the long-haul firm was able to use leasing to select more responsible drivers, to shift part of the operating risk to them, to reduce the difficulties of financing road equipment and to free management from much costly supervision.

These were all substantial advantages. But disadvantages of leasing were also evident. One of these was the extra cost of dock handling and storage required to equalize load revenues and ensure each trip yielded a profitable share to each owner-driver.

A more important disadvantage was the loss in control and utilization of tractor equipment. Company-owned tractors on long haul had an annual mileage utilization of about 50 per cent above driver-owned.[1] This higher utilization reduced maintenance costs per mile as well as obsolescence. It enabled firms with hired drivers to keep tractor investment at a minimum and to replace used tractors sooner with larger or more efficient equipment.

But whether the equipment they drove was their own or the company's, long-haul drivers were clearly indicated to be particularly capable as a group. Long-haul operations were preferred by the most experienced senior drivers, it was reported, even when their returns were no greater than on short hauls. Perhaps it was the degree of independence these operations afforded drivers. With the added incentive of much higher returns, senior drivers with the most skill and experience and highest safety records, competed for the long-haul berths. These applicants were carefully screened for ability, skill, responsibility, versatility, stability, personality and self-reliance. Only a few of these senior applicants were approved. Those accepted were expected to be versatile in handling special reports and costly and often intricate refrigeration equipment as well as other technical problems and to act as a public relations representative of the company in dealing with the public on the highway, with shippers and with provincial and state officials.

[1] This may be largely accounted for by the driver's tractor lying idle during the one week per month when he did not make a trip.

These responsibilities gave the long-haul driver a special status in his company. With the higher returns and a degree of independence added, it had attracted the best.

Rate Policies and Problems

Rate policies of for-hire trucking reflected the nature of the trucking industry and the type of traffic it carried. In this respect, several significant characteristics of the industry were noted. First, the continuing efforts of the industry to develop new, improved and specialized services implied a flexibility in pricing those services in relation to both their costs and their value (or savings) to shippers. Second, rate policies reflected the competition in the trucking industry, i.e., the greater number of firms competing relative, for example, to rail transport, the endeavours of these firms to improve their competitive position through improved services or costs, and the competitive drive of the smaller or newer firms to expand in spite of the established position of older and larger trucking firms. Thirdly, the nature of truck traffic made much of it relatively unsuitable for standard classification for ratemaking purposes.

Out of these characteristics of the trucking industry stemmed a different approach to pricing and rate control than that developed in railway transport. It was evident, for example, that the more progressive firms were content to follow established rates on standard traffic (such as canned goods, etc.) but wished to retain some freedom to adjust rates where specialized services were involved. Unlike most rail traffic,[1] the traffic carried by truck comprised mainly manufactured and processed goods which commonly required a much wider range of handling techniques and transport services. To the extent that this traffic offered continuing opportunities to the trucking industry for improving handling and hauling services, progressive trucking firms were hesitant to agree to hold to a fixed schedule of rates.

Yet most trucking firms favoured stabilized rates for the large and increasing volume of their traffic that fell into relatively uniform classes and required standard techniques in handling. On this traffic there appeared to be little difficulty in getting agreement among trucking firms to adhere to the standard rates that had been established by the various rate bureaus to which truckers belonged. Some firms, mainly the larger or longer established, went farther than this, supporting rate filing and public enforcement of such filed rates.

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[1] The composition of rail traffic is examined below. It may be sufficient to note here that since a major part of rail traffic is in commodities suitable for handling in bulk and large volumes, it is, in the main, more readily adaptable to standard transportation techniques and standard classifications for rates than most truck traffic.

On the other hand, for traffic subject to improved efficiency, or for firms that were more efficient or progressive than most, rigid adherence to a system of established rates was looked upon as a handicap. Because of this perhaps, the most efficient firms as well as small firms bent on expanding, were inclined to reserve some freedom in rate setting in those provinces where this was permitted.

Rate control may be aimed at protecting the shipper from excessive charges where a degree of monopoly exists (this is normally the function of public control) or protecting established trucking firms from unfair competition by other truckers (this has been accomplished to a degree by co-operation through highway traffic rate bureaus). It was apparent that rate control has always had a recognized place in trucking organization for either one or both of these purposes since very early in the industry's development. Yet paralleling this widespread support for rate control to protect the industry from undercutting of rates was the emphasis of trucking firms on their roles in providing special services to particular shippers, and their need to maintain some freedom to set special rates for those special services in order to maintain their competitive growth, especially when both the shipper and the trucker could gain by such special services and rates.

In those provinces which did not control rates,[1] the trucking industry had developed its own techniques for co-ordination of ratemaking on such traffic as it was deemed desirable. For some traffic, railway rates were reported to be commonly used as the basic standard for pricing highway services. Where railway rates no longer provided a suitable standard, e.g., on much short-haul traffic, rate bureaus supported by trucking firms had become established to develop orderly ratemaking.

The above considerations no doubt accounted for the greater concern for rate stabilization among short- and medium-haul operators than among those engaged in long haul. For long-distance operators, railway rates provided a clear guide for maximum rates. Their line-haul costs appeared to be their guide for minimum rates—the risk of loss by cutting rates below this minimum was correspondingly greater than for shorter haul operators. At the same time, indications that these line-haul costs permitted adequate freedom for competition with the railways were evident in the substantial reductions made in rail rates on dressed meat, livestock, butter and other commodities during the previous several years.

Viewing the industry as a whole, the survey indicated there were frequent complaints of detrimental rate cutting and much emphasis on the need for establishing uniform rates at a satisfactory level. It was also evident

[1] The Provinces of Ontario, Alberta and Newfoundland provided no rate control. In Quebec both intra- and extra-provincial rates were controlled. In other provinces, while regulations may require filing of rates, the extent to which the provincial governments determined rates appeared limited. Only Quebec required filing of extra-provincial rates.

that few firms were prepared to bind themselves entirely to following a uniform tariff schedule. The more efficient firms, in particular, appeared anxious to reserve a measure of freedom in rate setting so they might use their competitive advantages where necessary to attract profitable traffic. It was also apparent that fixed and controlled rates for all traffic could contribute to undermining the initiative of firms to improve their efficiency in costs and services. The more progressive firms recognized this initiative as a central feature of the competitive growth of the trucking industry in Canada.

Regulation and Taxation

Regulation and taxation of the for-hire trucking industry is carried out almost wholly by the provinces.[1] It is not the intention of this study to appraise regulation and taxation by the provinces in total because most for-hire trucking operations are intra-provincial while this analysis is primarily concerned with interprovincial-international transport. In the main, this study will examine regulation and taxation as they apply to longer haul trucking.

Within this field, the major problems in regulation and taxation as reported by trucking firms related to the freedom of new firms to enter the industry; the cost and difficulties of extending route franchises; lack of adequate reciprocity between some provinces and states (in licensing, weight and size limits, axle distances, clearance lights and such); costs of licensing and fuel taxes; regulation of piggyback; and others of less importance.

To appraise the significance of these problems it is necessary to examine briefly the background of regulation in Canada. In this respect, the development of trucking regulation in Canada reflects several major influences: the nature and stages of the development of for-hire trucking in various parts of Canada; the location of responsibility for regulation; and the diversity of provincial objectives concerning the growth of the industry.

For-hire trucking developed later in some provinces than in others but in all provinces it began as a local transport operation. It began as a service reaching out from the major industrial centres, primarily in Central Canada at first and later in other provinces. As an almost wholly local undertaking, for-hire trucking was originally intra-provincial and its early regulation was naturally designed for that type of service. Its later growth, particularly its rapid expansion in the decade of the 1950's, pushed it rapidly beyond local operations and at the same time raised new problems in the task of regulation.

In the process of this growth, intra-provincial trucking expanded greatly, to the point where it had supplanted rail transport in almost all

[1] General taxes such as corporation and sales taxes are, of course, levied by the Federal Government.

short-haul movements, particularly in Central Canada. Longer highway hauls, including interprovincial and international, grew rapidly also and continue to grow, adding appreciably to the difficulties of administering regulations geared to local operations. In 1957, the advent of piggyback to serve for-hire trailers, raised further difficulties in regulating local and interprovincial movements carried partly by highway and partly by federally-chartered railways.

No doubt because the early development of trucking was largely on a local basis, the regulation of all trucking became established as a provincial responsibility. By 1954, intra-provincial operations were still sufficiently dominant in the for-hire field that provincial responsibility for regulation of both intra- and extra-provincial trucking was considered essential. In that year, after the Supreme Court of Canada and the Privy Council had ruled that interprovincial and international highway operations plus intra-provincial operations incidental thereto, were a federal responsibility, the Federal Government delegated these responsibilities to the several provinces.

In these circumstances, it might be expected that considerable diversity from province to province would develop in the approach to regulation particularly as it applied to extra-provincial trucking. The basic objective of ensuring a safe and adequate highway transport service to shippers in each province was, of course, common to them all. Beyond that, considerable variation was encountered in freedom of entry of new firms, in extension of existing franchises, in licence rates and conditions, in load and size limits and in readiness to work out reciprocal agreements[1] with other provinces or states to facilitate movements beyond the borders of a province.[2] It was made clear by trucking firms that long-haul operations between Central and Western Canada would have advanced much more slowly if the Province of

[1] Reciprocity agreements among provinces and states usually apply only to licence or other fees. They become operative only if the other province or state grants similar privileges. They apply to vehicles registered in reciprocating jurisdictions but do not apply to intra-provincial operations. A recent summary of reciprocity agreements in Canada stated, in part, "Provincial reciprocity agreements vary widely both as to their content and extent of operation. The Maritime provinces, with the exception of Newfoundland (which has less interest in interprovincial and international highway operations) enjoy a general form of reciprocity with all provinces and states. In actual practice, however, agreements are in effect with only a few provinces and American States. By contrast, British Columbia, with a single relatively unimportant exception, has no reciprocity with any province or state. The remaining Canadian provinces fall between these two extremes. Alberta and Quebec have fairly extensive agreements with a number of provinces and states. Manitoba and Saskatchewan have limited types of reciprocal agreements with neighboring provinces and states, while Ontario with the greatest number of registered trucks, one-third of those registered in Canada, extends only a limited type of reciprocity to private vehicles and little or none to commercial and for-hire vehicles." See *Digest of Reciprocity Agreements, Railway Association of Canada*, April 1960, p. 1.

[2] Long-haul trucking firms reported that operating rights for interprovincial traffic were unduly limited by special regulations or restrictions varying from province to province. They indicated also, that, because of jurisdictional difficulties in handling extra-provincial highway and piggyback traffic, provincial transport boards in general did not encourage such operations.

Alberta had not facilitated this development by allowing new firms and new routes to become established and by extending its reciprocity agreements to cover the necessary routes. Other provinces have extended their reciprocity arrangements also. But, by 1960, full reciprocity for for-hire trucking was available in Canada only in the Maritimes and between some of the Maritime Provinces and Quebec and Alberta. As a result, the cost of licensing for interprovincial transcontinental operations was high.[1] However, good progress toward extending reciprocity agreements was reported by both trucking firms and the provinces. Prospects for future improvement were said to be favourable.

In the past, long-haul for-hire trucking depended largely on United States routes and the reciprocal agreements made by Alberta with intervening states and provinces. Even with these agreements, licence fees for such Alberta-based operations averaged $2,000 per road vehicle in 1960. In Central Canada, for-hire licences averaged about $900 per vehicle where interprovincial traffic between Ontario and Quebec was involved.

These licence fees, together with the tax on motor fuels[2] were designed mainly as levies to pay for the use of provincial highways by trucking firms. Most firms interviewed were satisfied with this general method of assessing user costs. But there was less satisfaction with the substantial disparities among provinces in the levels of these user levies, for example, in licence fee for light versus heavy vehicles, in taxes on fuel purchases, in taxes on fuel remaining in the tanks when entering from another province, in special tolls (mileage, vehicle, etc.) and such. At the same time, it was evident that most provinces had been caught relatively unprepared, in this respect, by the rapid growth of trucking in the 1950's, particularly longer haul operations. This may account for the provinces applying what appeared to be temporary measures designed to meet the immediate demands of the particular situation in each province rather than taking a more co-ordinated long-run approach.

Overall, the survey of trucking firms indicated they were aware that this growth of for-hire trucking had imposed an increasingly heavy burden of regulation on the provinces. It was apparent also that many of the provinces' difficulties stemmed from their responsibilities for regulating extra-provincial trucking, including piggyback movements, while having no jurisdiction over highways or highway operations outside their individual borders.

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[1] Reciprocity agreements made by Alberta with other provinces and states were reported to have saved long-haul trucking firms as much as $1,500 a year per truck in licence fees alone. At the end of March, 1960, Alberta had full free reciprocity with 24 states and Prince Edward Island and limited reciprocity with four states and Saskatchewan, Manitoba, Ontario and Quebec.

[2] In 1960, fuel taxes ranged from 11 cents a gallon in Manitoba to 18½ cents in Ontario for diesel fuel, and from 10 cents in Alberta and British Columbia to 18½ cents in Ontario for gasoline. Newfoundland levied a tax of 19 cents on both fuels but was not yet concerned with interprovincial trucking.

This need for greater co-ordination of licensing and other regulations was recognized by the provinces in 1959 by the organization of the Canadian Motor Vehicle Association, a body comprised of representatives of provincial highway transport boards. So far, progress in co-ordination has not been remarkable. It may be too early to say whether it will be possible for this Association to reach satisfactory compromises between their dual responsibilities (incompatible to a degree) for regulating, on the one hand, provincial transport, and, on the other hand, interprovincial transport.

The prevailing view among longer haul operators in the survey was that as extra-provincial traffic continued to expand the demand for co-ordination of regulation among provinces would further outstrip possible progress in this direction; that Canada would eventually be forced to follow the path adopted in the United States more than a decade ago. There, as interstate highway transport reached substantial levels, it became necessary to shift more responsibility for it to the Interstate Commerce Commission.

Yet longer haul trucking firms had not organized as a body to promote such a development. The trucking industry had been organized primarily on the basis of provincial associations which in turn were joined together to form the Canadian Trucking Associations. The long-haul operators were active members of these provincial associations. Yet summarizing their views broadly, it seemed clear these long-haul firms were convinced that the conflicts and burdens being thrust on the provinces by the growth of their operations and of piggyback, would eventually call for increasing federal support. The expansion of long-haul trucking into the field of national transportation and its continued encroachment on rail traffic also indicated this. Complex difficulties and conflicts were being encountered by the provinces in attempting to regulate this long-haul traffic. They included: regulating highway or piggyback movements where the province had effective control of only one end of the operation; the high cost of building and maintaining highway facilities to serve extra-provincial trucking needs; the complex task of reconciling the provinces' objectives and policies for intraprovincial transport with those for interprovincial and national transport; the relative decline in the role of national railway services in meeting provincial transport needs; and others. These difficulties of provincial regulation appeared likely to multiply with the continuing rapid change in the pattern of transportation in Canada.

Scale of Operations

Concentration

It is a measure of the increasing stability and prospective profitability of the for-hire trucking industry that substantial amounts of outside capital

were invested in it during the decades of the 1940's and the 1950's. The first major venture in this direction came in the early 1940's when the DuPont interests purchased control of Terminal Warehouses in Toronto and through them purchased several trucking firms. These firms were merged or extended to form the three present companies, Direct Winters Transport in Ontario, Direct Motor Express in Quebec and Direct Winters Transport Incorporated in the United States.

In the years following, i.e., in the middle and late 1940's, several oil companies bought control of for-hire trucking companies but later disposed of most of these interests.

About 1948, the N. M. Davis Corporation purchased Inter-City Truck Lines, a fairly large Ontario firm engaged in short-medium hauling. In 1953, the Davis Corporation added Trans-Canada Highway Express, a long-haul company (Alberta to Halifax) and later established Inter-City Tankers Ltd.

About 1952, the Roy Thompson interests through their Dominion Roadways, a holding company, purchased an interest in car-hauling firms (McCallum Transport, Oshawa; Stan Brown Transport, Windsor; and McCallum Transport, Montreal). Roadways also purchased Walter Little, Ltd., of Kirkland Lake which owned two smaller firms and on January 7, 1961, bought Simmonds Transport of Midland, and Kochois of Windsor.

Probably the biggest and most rapid consolidation through outside capital started about 1955 when the Drayton interests began to build up what is now Canadian Motorways Corporation. This was done through British Electric Traction Ltd., which in 1960 held the controlling interest in Motorways. Altogether some 52 companies were merged and these have now been consolidated into three major branches: Motorways (Ontario), Motorways (Quebec) and Soo Security Motorways in Western Canada; plus Thompson Transfer in Nova Scotia and several furniture warehousing and moving firms (Hill the Mover, Capital Storage, and others). The most extensive growth in Motorways was in 1957-58.

Another major consolidation has been made by Canada Steamship Lines (CSL). In the early 1940's CSL purchased Kingsway Transport, Montreal; in 1957, Arrow Transit Lines, Winnipeg; in 1958, Gossett and Sons, Alberta; in 1960, Brocklesby Transport, Montreal; in January, 1961, Drummond Transit, Montreal; and in January, 1961, Kingsway had an application before the courts to purchase the bankrupt Dalewood Transport of Hamilton.

The largest trucking complex in Canada had been assembled under CPR control. It comprised in Eastern Canada, Smithson Holdings purchased in 1958 (including Smith Transport, Toronto; H. Smith Transport, Quebec; and Smith Transport Inc. in the United States); Deluxe Transport, North Bay; Norman's Transfer, Montreal; Montreal-Cornwall Transport, Montreal;

and Bridges, Cornwall. These were linked through Smith Transport to Western Canada where the CPR operated Canadian Pacific Transport, Dench of Canada, O.K. Valley Freight Lines, Canadian Pacific Express, Island Freight Service, and others. The CPR holdings were built up mainly since World War II. In 1960, they provided a fairly comprehensive national trucking service. There were indications that year that this consolidation of truck lines by the CPR was approaching completion. Its trucking services extended from Halifax to Vancouver Island and provided many truck routes into traffic areas that CPR rail lines had formerly not served.

The CNR, which had delayed its highway operations, moved in this direction on a major scale in 1960 by taking an option to purchase on Midland Superior Express, Calgary, a major long-haul operator, purchasing East-West Transport, another long-distance firm, as well as several smaller companies. The emphasis in the CNR development in 1960 was thus mainly in long-distance trucking.[1]

The above includes the major consolidations in the Canadian trucking industry. In spite of these consolidations the degree of concentration in the for-hire trucking industry in Canada was still not large, though the over-all CPR organization was approaching a dominant position.

This relatively small degree of concentration was evident in the results of the survey of trucking firms. The survey included some of the largest scale for-hire operators in the industry. The five largest of these handled only about 2.8 per cent of the tonnage hauled by all Canadian for-hire trucks in Canada in 1959.[2] This level of concentration may be attributed partly to the stage of development of the trucking industry in Canada. But, in addition, the possibilities for profitable large-scale operations were indicated to be fairly limited.

Economies and Diseconomies of Scale

These limitations appeared to be related to the increasing difficulty encountered, as the scale of operations increased, in efficiently co-ordinating the large number of highway and P & D vehicles, each of which must be operated independently to a degree. By its nature, truck competition depends on speed, flexibility and service. A substantial measure of these advantages may be lost through the build-up of supervision and other controls necessary to co-ordinate the large number of vehicles and terminal operations involved in serving the extensive area covered by large-scale undertakings.

Offsetting advantages of larger scale trucking were: greater ability to provide full service to shippers; opportunities for auxiliary services such

[1] In 1961, the CNR was negotiating for the purchase of Husband Transport Ltd., a major short-medium-haul firm serving the area from Windsor to Montreal.

[2] Neither CPR nor CNR trucking operations are included as a unit in this figure.

as warehousing, tankers and bonding; a wider diversity of traffic that made such large firms more independent of individual shippers; and such.

The survey data indicated, however, that the over-all opportunities for efficiency and profit were greater in the medium-size firm, i.e., firms with a traffic volume in the neighbourhood of 75 to 150 million ton-miles a year. Profit rates at this scale were regularly higher than for larger firms. In addition, the evidence indicated this medium-scale firm could make full use of top level management, yet was not so large as to lose that close supervision, flexibility and special attention to the individual requirements of shippers that larger firms were in danger of losing. Such medium-scale firms also appeared able to take quicker advantage of opportunities to develop new, profitable services for shippers.

In the newer and relatively smaller firms, there was also considerable evidence of more initiative, greater readiness to adopt new cost-reducing or service-improving innovations, and greater emphasis on efficiency and full utilization of equipment. Several of the long-haul firms were notable in this respect.

In short, the survey results would confirm the findings of previous studies which show truck transport is not subject to any marked economies of scale beyond a medium-sized operation and does not fit closely into the traditional pattern of natural monopoly in transportation.[1] Yet while there was little to indicate that highway transport in Canada would become dominated by one or few firms (although opportunities for unlimited growth of rail-truck combination firms would constitute a reservation in this respect), this does not mean that elements of monopoly do not exist. For example, there was still relatively limited scope for competition on some highway routes where the number of firms permitted to compete was commonly limited by provincial restrictions on the entry of new firms.

Significance of Organization for Services

Competition between truck and rail transport is partly on the basis of service and partly on costs or rates. Costs are taken up in the following section. Here services are examined.

Certain features of the organization of for-hire trucking were notable for the unique services they enabled trucking to provide. Some of the most significant of these features were:

1. The scale of each firm's operations, being relatively small, permitted positive and co-ordinated control by management over all operations and direct negotiation between top management and shippers.

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[1] Cf. Geo. W. Wilson, *The Nature of Competition in the Motor Transport Industry*, Land Economics, November, 1960, p. 388 et seq.

2. Transport operations were commonly concentrated in a limited area or on a limited number of routes. Individual trucking firms were not required to provide a complete transport service. Many concentrated to a degree on special classes of traffic though L.T.L. was generally carried.
3. Each highway vehicle was operated as a separate unit and, carrying a relatively small load, its operation could accordingly be efficiently adapted to the frequency of delivery and other unique preferences of individual shippers. This eliminated the need for standardizing equipment to the extent required in railway train service and freed these vehicles from the inflexible time schedules required to co-ordinate train service.
4. Drivers, many above average in qualifications, were able to give specialized service to particular shippers with whose requirements they were commonly familiar.
5. With investment largely in road equipment and each vehicle a discrete unit, it was possible for trucking firms to add or reduce equipment in the short run to meet changing customer demands. This applied also to terminal investment to a major degree. With the relatively small investment in "sunk costs" in comparison with the railways, the investment in trucking was remarkably adaptable to the new and changing demands of shippers.
6. Equipment was commonly adapted especially in construction, refrigeration and size to individual shippers' requirements. Costs of such adaptation were relatively small because only the trailer was ordinarily so modified.
7. Trailers could be loaded and sealed by the shipper at his dock and then moved directly to the consignee without passing through switching, central classification or clearing operations. With loads smaller than box car loads, door-to-door deliveries were possible, deliveries were more frequent (keeping inventories low) and made at a time convenient to the consignee.

These features of for-hire trucking gave it speed, flexibility and control of operations that were particularly attractive to a growing number of shippers. Under these conditions, trucking had major competitive advantages over other modes of transport in providing special transport services tailored to individual shippers' needs. The survey showed that the trucking industry was well aware of its advantages in this respect. It had in fact organized its operations primarily around those classes of traffic for which special services were most valuable.

The development of this organization of trucking designed for special transport services and the readiness and ability of trucking firms to supply services to shippers was paralleled by a substantial growth in the demand for these services. This demand rose rapidly during the 1950's and continued rising into the 1960's.

The increase in demand for services can be attributed largely to changes in the structure of the Canadian economy and the new pattern of demand for transport services that developed out of these changes. The expansion (with some dispersion) of the processing and manufacturing sector since the 1930's is one of these structural changes. Studies indicate also a massive diffusion of manufacturing from the centre toward the periphery of industrial areas mainly since 1948.[1] To a considerable extent these changes represented a regrouping of industry around the highway systems and a movement away from railway sidings, team tracks and freight sheds. An increasing number of plants are no longer served directly by rail facilities.

Along with this increasing dependence of manufacturing plants on trucking services has gone a substantial increase in Canada's output of manufacturing.[2] From 1940 to 1960, the physical volume of manufacturing increased two and a half fold, from 1949 to 1960 it rose 50 per cent. This expansion in the volume of fabricated, high-valued goods resulted in a sharp increase in the demand for the extra services required to handle and transport them most effectively, the services that trucking was particularly well equipped to provide.[3]

These services may be briefly summarized as:

1. *Speed and frequency of service.* Overnight service was given on over 90 per cent of short-medium hauls and faster than rail service on long hauls. Small-load efficiency permitted frequent deliveries at shipper's preference.
2. *Quality and damage control.* Close personal supervision of refrigeration and air conditioning, less physical damage, fewer claims, faster settlement of claims, and less stringent packaging than railways are features of this.
3. *Adaptation to shippers' preferences.* Specialization in types of equipment (special trailers, tankers, etc.), in loading at shipper's dock, in trip schedules, flexibility of P & D operations, and many other such services.

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[1] David W. Slater, *Decentralization of Urban Peoples and Manufacturing Activity in Canada,* Canadian Journal of Economics and Political Science, XXVII, No. 1, p. 83.

[2] In 1960, manufacturing comprised 77 per cent of total industrial production, mining 15 per cent and electric and gas utilities 8 per cent.

[3] Numerous other changes in the economy—the suburbanization of final goods distribution, the growth in output of processed and perishable goods, more packaged shipments, for example—had also added to the demand for such services.

In short-haul operations in Canada these services, together with certain cost advantages, had enabled trucking to take over most of the freight traffic within the 300- to 400-mile haul range. At the same time, shipper's costs had been reduced, relatively. In long haul, where trucking had fewer cost advantages over the railways, these service advantages were the major factor in attracting a rapidly growing volume of traffic to the trucking industry.

Truck Versus Rail Costs

The shipper's choice between rail or truck transportation is influenced by relative costs, reflected in rates,[1] as well as by the bundle of services provided by each method. In short, both relative costs by rail or truck and the services that go with these respective costs must be compared to appraise the competitive advantage of each method of transport.

Direct comparison of truck and rail costs is, however, subject to several substantive limitations. In the first place, there is a lack of comparable cost information. Secondly, trucking costs commonly cover a larger bundle of services than rail transportation provides. A third limitation is related to the large volume of bulk rail traffic on which service and costs are low but weight per cubic foot of space is relatively high. As a result of the last two, comparison of average costs on ton-mile or cwt. basis, rail versus truck, may not reflect accurately the relative value of transportation services provided by each mode to shippers.

Truck Costs

Thus average cost data which showed truck costs at 5 to 6 cents per ton-mile against rail costs at 1.5 cents,[2] may have little meaning in terms of relative values. About 70 per cent of rail traffic is heavy, bulk primary products (grain, ore, lumber, etc.) much of which is mechanically loaded and moves in trainloads over relatively long distances. This large volume of traffic is particularly suited to low-cost movement. Few special services are required, revenues are low and costs are low. Rail costs on this traffic are low enough so competition from trucks has been negligible.

In trucking, on the other hand, average costs are a function of the large volume of L.T.L. traffic (with its numerous stops and manual handlings for P & D and dock) and of the flexibility and extra services provided on other types of traffic. Costs on this traffic are largely variable costs and directly related to the work done.

The variable costs by truck, for this traffic on which trucks specialize, can be substantially lower than by rail because of the economies of small-load operation and the closer control and supervision possible in trucking. In addition, fixed costs in trucking are low relative to the railways.

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[1] In the past, freight rates were less likely to be a reflection of costs than they have become today, particularly in traffic areas where truck-rail competition is keen.

[2] See J. C. Lessard, *Transportation in Canada*, a study prepared for the Royal Commission on Canada's Economic Prospects, 1957, p. 81. This study did not, of course, presume to analyse these relative costs. Mr. Lessard's estimates compare closely with average revenues per ton-mile in 1958, 6.8 cents for for-hire trucking and 1.55 cents for the railways. See DBS, *Motor Transport Traffic, 1958*, and *Waybill Analysis, 1958*.

What this means is that, although average ton-mile costs for total truck traffic may be substantially higher than average costs for rail traffic as a whole, the evidence indicates that rail costs would be substantially higher than truck costs on much of the traffic now handled by trucks.

In other words, these particular cost advantages of trucking have significance for competition in particular classes and areas of traffic. Cost information obtained in the survey demonstrated this. For example, average all-inclusive costs for short-medium-haul firms in the survey were estimated to be 7.12 cents per ton-mile.[1] Yet truckers stated they hauled at these costs 75 per cent of all traffic within this 300- to 400-mile haul range. Because of their cost advantages in this haul range, trucks were also competing there effectively for much of the bulk, heavy, lower rated traffic.[2] On L.T.L. and other higher rated traffic their competitive advantage was more substantial.

Breaking down this 7.12 cents, the all-inclusive ton-mile cost for short-medium-haul trucking, the survey showed that slightly over half (3.59 cents) was for P & D, dock handling, etc., and only 3.53 cents was line-haul highway costs.[3] As was indicated above, trucking had cost advantages over rail in these P & D and other handling operations. In short hauls, this advantage was supported by certain economies in line-haul operations—e.g., fewer costly delays such as the railways have in assembling, switching, classifying, turnarounds, etc. The cost survey also showed that these short-haul cost advantages for trucks have now extended into medium-haul operations. Medium-haul costs may, therefore, not be out of line with rail costs, for comparable traffic, as has been indicated.[4] In addition, where there was a gap between railways and trucks in line-haul costs, trucking had evidently narrowed the gap by cost advantages in P & D and dock handling and by technological gains in improved highways and road equipment. Trucking may be expected to narrow this line-haul cost gap further as such technical improvements continue.

In brief, for short-medium hauls, trucks have substantial cost advantages in P & D and dock handling. On these hauls also they have substantial advantages in some line-haul costs. Along with these, they supply many special services (speed, frequency of small-load deliveries, quality and damage

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[1] See Appendix A, p. 92. Average load on these short-medium hauls was ten tons.

[2] Steel, for example, with 18 to 20 or more tons per truck load was being hauled for all-inclusive costs as low as 2.39 cents a ton-mile on 500-mile hauls.

[3] This is the all-inclusive cost. Out-of-pocket line-haul costs were 2.82 cents per ton-mile. Meyer, *et al.*, (p. 92) calculated out-of-pocket line-haul costs at 2.73 to 3.05 cents a ton-mile based on U.S. Middlewest estimates.

[4] For example, Meyer, *et al.*, *The Economics of Competition in the Transportation Industries*, Harvard, 1959, concluded that trucks have a cost advantage (including P & D and line-haul) only within a haul range of 100 miles or less, p. 194. Yet later in that study it showed that over 97 per cent of for-hire truck hauls were over 100 miles. The author's conclusion: that shippers were not choosing the most economical method of transportation because rates did not reflect costs. In fact, substantial areas of services provided by trucks in excess of rail services were not included in the Harvard study.

control and adaptation to shippers' preferences) that the railways cannot conveniently provide. These special services are highly valued for certain classes of traffic. In appraising rail versus truck line-haul costs, it may be necessary to deduct the value of these extra services from truck costs to make them comparable to rail costs.

Turning to long-distance trucking, the cost advantages in P & D and dock handling were not as great as in short-medium hauls since these costs were a relatively smaller proportion of total costs. But long-haul trucking had maintained and expanded the superiority in special services to shippers. In addition, it had gone further in technological improvement, especially in road equipment, and this permitted larger payloads to be carried and ton-mile costs to be accordingly reduced.

With this larger payload (loads averaged 14 tons), all-inclusive costs for long-haul trucking were on estimated 3.25 cents a ton-mile and line-haul costs 2.94 cents a ton-mile.[1]

Trucking firms reported in the survey that ton-mile line-haul costs were reduced in long-haul trucking relative to shorter hauls by:

1. Careful loading to utilize maximum space and weight capacity.
2. Lower driver cost through more continuous driving.
3. Lower maintenance costs through greater equipment utilization.
4. Relatively lower costs for terminals and terminal equipment.
5. Lower overhead because of less complex management requirements.

Part of these cost advantages were offset by:

1. Lack of communication with drivers.
2. Higher costs for fuel and repairs between terminals.
3. Higher costs for stowage and licensing.

Relative to the railways, long-haul trucking had similar cost economies to short-medium operations in P & D, dock handling as well as closer control and flexibility of small load efficiency. But in long haul, these cost advantages, being diffused over more miles of line-haul, became less significant in over-all cost competition. No doubt to compensate for this, the long-haul operators had given more emphasis to efficiency in line-haul costs and to special services. Use of larger and more efficient road equipment, careful stowage and full loading had raised payload enough to reduce line-haul costs per ton-mile 17 per cent below such costs in short-medium hauls, thus bringing them significantly closer to efficient line-haul rail costs. In services,

[1] See Appendix A, p. 92. Out-of-pocket line-haul costs were 2.41 cents per ton-mile, well below short-medium trucking.

more attention had been given by long-haul operators to exploiting their advantages over the railways in speed of delivery, closer supervision of refrigeration for perishables, scheduling shipments to meet consignee distribution and receiving preferences, developing special services for particular commodities,[1] and others. There were costs involved in providing these extra services which shippers desired but the railways could provide them only at much higher cost, if at all. They were valuable enough to shippers to make truck transport preferable even at higher rates, in some cases, than by rail. The organization of these special services of long-haul trucking had become developed and recognized by the late 1950's. By that time they had become an integral part of cost competition. Broadly speaking, shippers had the choice of slightly higher line-haul costs plus extra services, by truck, or somewhat lower line-haul costs without these services, by rail. For a very rapidly increasing volume of traffic the extra services were preferred.

Viewed thus broadly, the critical area of truck-rail cost competition lies between two extremes. On the one extreme is the short-medium-haul transportation where economies in handling small shipments, in short hauls, in small loads and in other aspects, give trucking decided competitive advantages for most traffic. On the other extreme is the traffic that can be handled in bulk or trainload movements by direct long hauls from terminal to terminal. For most of such traffic the railways appear to have marked line-haul economies.

Between these two extremes the competitive positions are less clearly defined. Trucking, for example, may meet strong rail competition on hauls beyond 500 to 600 miles except where extra services are demanded or where traffic densities are light. But the railways may similarly find it impossible to compete even on long-haul trainload movements for traffic that requires special services (such as continuous supervision of refrigeration temperatures) which the railway may not readily provide.

Yet it should be emphasized that these competitive cost conditions are now dynamic rather than static. In future, the cost advantage could swing more toward trucking, especially in this middle area of cost competition that lies between the two poles of advantage noted above. A major factor in this will be the extent to which trucking makes further inroads on railway traffic. Wherever truck competition continues to reduce the volume hauled by rail, railway costs per unit of traffic may be expected to climb. This is because such a large part of rail costs are unavoidable (e.g., costs of investment and maintenance of roadbed, management and other overhead costs)[2]

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[1] One example: for the growing livestock hauling operation from Alberta to Central Canada, special cattle-liners were developed, intermediate unloading and feeding stations were established and faster hauls enabled only one stop for feeding against two for the railways.

[2] Road maintenance costs, for example, in 1960 for the CNR were 23 per cent of total railway expenses; for the CPR, 19 per cent.

and must be spread more heavily over the smaller volume of traffic. By the early 1960's, it was already evident that the railways had reached a stage where further losses in this middle area could push costs for certain rail traffic sharply upward.[1]

This trend to increasing railway costs was most marked on the relatively low-density branch or main lines, in particular classes of traffic such as perishables[2] and in the area of medium- and some long-haul traffic. Wherever these areas of increasing rail costs had developed, a fertile field for expansion of truck competition was opened.

In for-hire trucking most of the costs are variable, i.e., they are avoidable, going up or down directly with increases or decreases in traffic volume. With so little of its investment in sunk costs relative to the railways, trucking was not ordinarily subject to variations in unit costs like the railways.[3] In addition, technical improvements had tended to hold trucking costs down or reduce them. In consequence, cost competition by for-hire trucking had continued to strengthen and it may be expected to extend farther into traffic on low-density rail lines, into medium- and long-haul traffic which demands special services and into other traffic that cannot be readily fitted into direct terminal-to-terminal trainload movements.

Rail Costs

The rate at which trucking continues to erode rail traffic depends to a major extent on how effectively the railways are able to organize in future to capitalize on their own cost advantages. Cost advantages in rail transport are substantial but there are many obstacles to utilizing them fully. Notable progress in recent years has been made in overcoming some of these obstacles and this is taken up in a separate section below. At the same time, there is good evidence that for some traffic the railways are not providing the cost competition they are capable of and on other traffic the

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[1] Dr. O. M. Solandt, vice-president, CNR, has described the current "plight" of the railways in this respect as a "vicious spiral". The railways, he said, "are faced with rising costs . . . which lead to declining profits. If they raise their rates . . . to improve their revenue, the result will be a declining volume of business. Because of the very high fixed costs of railways, this declining volume will lead to a sharp increase in unit costs, hence the railways (would soon) . . . be in a position of moving less traffic at high prices and also at higher costs". See *The Canadian Transportation System—A Vision of the Future*, address to the Toronto Railway Club, December 1960, p. 10.

[2] Especially where special equipment, supplies and staff must be maintained by the railways to service a limited volume of traffic.

[3] Except for fairly small firms, for-hire operators can readily adjust investment to volume of traffic by failing to replace worn-out vehicles when traffic falls and adding new ones when it increases. Cf. also Meyer, *et al.*, "For the larger firms, the important operators of long-distance equipment, . . . the size of the truck fleet can be adjusted to the volume of traffic. Therefore, all line-haul costs can be considered a variable expense.", p. 91.

full costs by rail may be much too high to warrant continued competition with trucks.

Too often in the past there has been a tendency to look only at the calculated line-haul economies of rail transport and fail to examine why there is such a shortfall in capitalizing on these economies. Both must be assessed in appraising the competitive potential in costs. This can be done only broadly here.

The cost advantages in rail transport lie in its potential economies in man-hour productivity, fuel costs and capacity. It has been calculated that railways produce about six times as many ton-miles per man-hour as do trucks; that full costs for a diesel locomotive is about .036 cents a net ton-mile against .17 cents for a diesel truck; and that a single track rail line has about seven to eight times the freight capacity of a two-lane highway of equivalent cost.[1] These major advantages are substantial but it may be obvious that it requires large cars in large trainloads moving regularly on long, non-stop hauls to capitalize on these advantages. For a substantial volume of their traffic it is possible for the railways to operate in close to this fashion. Where they can do this, rail costs, with a satisfactory back haul, may be as low as a cent or less per ton-mile. But such costs do not apply on that share of Canada's freight traffic that has shifted from the railways to dependence on trucks. For this important volume of traffic rail costs are much higher than this.

To appraise broadly why railway costs depart so widely in some cases from this optimum it is necessary to visualize the great magnitude of sunk costs involved; the vast fixed plant established from coast to coast with its inherent rigidity in routes and services; the increase in low-traffic-density lines; the costly and inflexible systems of centralized management and accounting; the costs and physical difficulties of adapting this structure to modern competition; the inflexible routines and techniques established by tradition and regulation for handling traffic and road equipment in freight operations; the interweaving of labour institutions with the operational structure; the established aim of the railways to provide a complete transport service to all shippers rather than a selective service like trucking; and the limitations imposed on change by public policy.[2]

This environment has much significance for rail cost competition. It indicates the inflexibilities that delay or prevent the railways from adapting their operations to meet growing truck competition. It suggests why some rail costs may be significantly higher than might be expected. It leads to the conclusion that unless the railways can break through the barriers imposed

[1] *Railway Research,* an address by Dr. O. M. Solandt, vice-president, CNR, to the Association of Professional Engineers, Vancouver, December, 1960, p. 5.

[2] Both major railways have plans under way for remedying some of the deficiencies in this field (see below) but much remains to be done.

by this environment, any cost advantages they may have could well be dissipated on the extra costs involved in this kind of operational environment.

This may be illustrated by examining briefly a few of the key areas where railway costs may depart widely from the theoretical normal costs in those traffic areas where they compete with trucking.

But before taking these up it would be well to note the handicaps now faced by the railways in appraising their competitive potential in these key areas of competition with highway transport. A major obstacle (though there are others) to adequate appraisal may be in the railways' organization of centralized management and accounting. By its nature, this organization was dependent on systems of standardized services and on averaging of costs. In these circumstances, it had been most difficult for them to appraise adequately the competitive bundle of costs and services being offered by truck competition in a particular area or a class of traffic or to appraise why the railway service was not competitively more effective. In many cases, it seemed evident that if the railways had enough on-the-spot, local information on relative costs and services by rail and truck to assess adequately their competitive potential, they would have altered their operations more readily to suit the competitive situation.[1] This lack may have prevented desirable specialization and adaptation of costs and services to local demand. It appeared to be a major reason for the railways continuing certain practices and operations which a careful investigation would indicate were clearly uneconomic.[2]

This may be illustrated by citing a few features of rail operations that appeared likely, by keeping rail costs high, to encourage increased competition and enable further traffic inroads to be made by trucks.

1. The large volume of L.C.L. traffic still handled in box cars (11.8 per cent of revenue cars in 1960) through freight sheds (requiring four more handlings than by truck) and team tracks (requiring two extra handlings). Such operations may require excessive handlings relative to trucking and may decrease the productivity of both railway equipment and manpower.[3]
2. The excessive and costly delays, in handling box car traffic, due to switching, assembling, classifying, stopping whole trains to

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[1] New techniques for calculating costs, based on multiple regression and computer methods, will do little to remedy this deficiency. In the main these new techniques are subject to the same weaknesses of using cost averages and general services that former costings were exposed to. The solution is likely to lie more in developing a system of specialized costing that can focus its appraisal of competitive costs and services on the local or particular areas or classes of traffic where truck competition is significant.

[2] In this context, those practices and operations which public policy requires the railways to perform may be excluded.

[3] Cf. Meyer, *et al.*, p. 102-103.

set off a car or two at intervening stations, and such, estimated to consume 78 per cent of the rail time between origin and destination.[1]

3. The use of costly centralized management and accounting procedures that prevent local adaptation and specialization of services and accurate appraisal of costs, rather than management control and costing methods designed more for making rail services more flexible and specific at the local shippers' level and directing them particularly into those operations where the railways have most advantages in costs and services.[2]

It may be apparent that the extra costs of the inefficiencies in all three of these areas apply particularly to the traffic on which trucking competition is most severe. A preliminary appraisal would suggest these extra costs may add as much as 50 to 100 per cent or more to the costs of an efficient, well-organized rail or combined rail-truck operation for such traffic. Under these conditions, such rail costs may be well above truck costs on this type of traffic and further erosion of rail traffic by highway transport may be expected. These circumstances are also significant in appraising the future outlook. In view of the many organizational and structural obstacles, outlined above, that the railways still face in adapting their operations to lowest cost competition, it seemed likely that trucking would reach more deeply into railway traffic, even in those areas where railways could have substantial cost advantages, before the railways had completed their adaptation to the new competitive environment.

[1] Estimates based on 1960 railway operations show the time lost on the average rail haul (445 miles) in these operations relative to truck time would approximate:

Switching at terminals	25.4 hours
On sidings en route	2.2 hours
Assembling and switching at origin and destination	48.0 hours
Hauling time	7.7 hours
	83.3 hours

Actual hauling time by rail averaged 21.7 hours, or only 22 per cent of the time, from origin to destination. These calculations are based partly on data in Meyer, *et al.*, p. 192-193.

[2] The difficulties of making these changes should not be under-estimated. But steps now being taken by the railways in this direction seem likely to be too little and too late. The 1960 Annual Report of the CNR states, "The transfer of responsibility to the regional and area levels under the new plan of organization, requires a reorganization of the accounting function. To meet this need, a program was introduced to modify the accounting system, over a period of time . . .".

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Pattern of Truck-Railway Competition

From the above review it may be discerned that the pattern of truck-railway competition is a fairly complex configuration of costs, services and the related flexibility to adapt to shippers' demands. In effect, this means that competition extends into both the supply and the demand sides of the market for transportation.

But so far this examination has been concerned mainly with only the supply side, i.e., the conditions of competition in terms of relative costs and services by truck and rail. A few decades ago this may have been sufficient. More recently shippers' demands or preferences have clearly risen to importance in competition as alternative services of trucking have been extended into traffic areas formerly serviced by railways alone.

Preliminary to looking at this demand side, it may be useful to summarize broadly the supply relationships that shipper demand faces. This will provide a basis for assessing the scope of preferences that may be satisfied as well as the potential of each mode of transportation in competing for particular traffic.

On the supply side of transportation two main features stand out. First, transportation involves a wide range of costs and services and these may need to be selectively adapted to the demands of particular types of traffic. Second, the ability to supply particular services at acceptable costs on this selective basis depends to a large extent on the unique cost advantages as well as on the flexibility of operations that each mode of transport enjoys.

On the supply side for trucking, the competitive pattern has shown certain areas of advantage in costs and services. In costs, trucking is relatively flexible and adaptable in the short run, both in labour and capital, to demand changes involving either volume or types of service. This flexibility has permitted costs to be kept relatively low for dock handling, P & D, small shipments, short hauls, low-density traffic and other operations.

In services, trucking is particularly well equipped to provide special services to individual shippers. Its organization (i.e., its small scale relative to railways which gives more positive control of operations, local concentration, driver responsibility, flexibility of individual road units and other elements) permits services to be tailored closely to individual shippers' preferences.

In comparison, railway costs are relatively low for trainload, bulk-handled movements which require a minimum of services. But they are relatively high on freight shed handlings, small shipments, short hauls, low-density traffic and special services.

In services, the railways are less capable of supplying the specialized services that trucking is uniquely fitted for. Railway services tend to be

standardized, to serve uniformly the main body of freight traffic. This generalized service by the railways commonly requires shippers to fit their transportation needs to the railway services offered, rather than the reverse, as in trucking. This non-specific nature of railway services is the result partly of certain structural rigidities that greatly limit the flexibility of rail services (the necessity for fixed scheduling of trains, the rigidity of routes inherent in fixed roadbeds, the large scale of operations and such). It results in part also from organizational rigidities (centralized management and control; standardized regulations and rates; little local responsibility for claims, rates and other specialized services; and the limitations imposed by public policy). In spite of these handicaps, railway services have been improved substantially since World War II as will be shown below. But railway progress in improvement has been slow relative to the growth of truck competition. Its progress will continue to be slow in this direction because of the above structural and organizational rigidities, many of which are inherent in railway operation. In fact, because of these, the railways should never be expected to reach the level that trucking may attain in service competition.

These are characteristics of the supply side of transportation—a complex structure of various services offered at various prices by truck and railway to meet the varying demands or preferences of shippers for transport services.

During the past few decades the demand side has grown increasingly more complex also. The increased volume of manufactured and processed goods together with the growth of competition, particularly in the provision of special services by trucking, has opened the way for shippers to demand a wide range of new services. This demand for services varies from shipper to shipper.

The simple equation, commonly used in the past, to describe total demand in terms of price as a function of weight and distance falls far short of representing today's conditions. The characteristics or nature of the traffic, other than its weight and haul distance, have risen to great prominence in shipper demands. Broadly speaking, the components of demand that play the most influential roles in truck-railway competition are: the nature of the traffic, haul distance and density. These influences on demand warrant scrutiny.

The nature of the traffic determines to a large degree the type and extent of services demanded by the shipper as well as the relative prices he is willing to pay for them. Some of the most important traffic characteristics to be distinguished in this context are whether the traffic is bulk-handled or packaged; low-valued or high-valued; heavy or light per unit of space; in large or small shipments; perishable or non-perishable; low or high in loss-damage risk; and so on. On traffic, for example, that is manually handled, high in

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value, perishable and subject to high damage-loss risk, more services will be demanded and a higher price offered by shippers than for bulk-handled, low-valued, non-perishable freight. In short, characteristics of the traffic determine the value of services preferred, the risks involved, the preference for speed and frequency of delivery and, in consequence, the price the shipper is willing to offer.

Distance is still a major factor in demand and in the determination of price. But its significance, in these respects, has been notably reduced for a substantial volume of traffic by the relative growth in value of special services. This change is particularly notable in the case of long-haul trucking, where the preference for extra services by shippers has enabled trucks to compete over distances on which railways would tend to have the advantage were line-haul costs alone considered. This tendency is also evident in short-medium hauls where extra services (in addition to certain cost advantages) have given trucking a substantial advantage in the competitive race with the railways.

Density of the traffic demand has become increasingly significant in the case of railway transportation. Trucking can, by its nature, adapt to very low-demand densities. But for railways, traffic demand must be in much greater volume, i.e., sufficient for regular trainloads involving few stops, if they are to gain the competitive advantages of their minimum cost operation. This adverse condition of low demand density has developed in numerous railway traffic areas, for example:

1. On an increasing number of branch lines.
2. In heavy traffic areas where short-medium-haul trucking has taken over the major volume of traffic, leaving the railways to meet mainly the demand for the remaining low-valued bulk commodities, a demand that is often intermittent and thus costly to service.
3. In long-haul operations that require special services for particular types of traffic, density of demand may not be great enough to enable the railways to maintain such special services (e.g., supervised refrigeration for perishables) at a price shippers would be prepared to offer, that is, a price that would be competitive with truck prices.

To assess fully the relative potentials of truck versus rail competition on the basis of these demand factors (i.e., nature of the traffic, distance and density), it would be desirable to appraise the total demand for transportation in Canada in these respects. Unfortunately, this kind of information is not

available for all freight traffic. But part of it, perhaps the most significant part in this context, is available, namely, data on railway traffic. Railway traffic comprises about half of total freight traffic.

An appraisal of such traffic can show a great deal about the nature of demand for railway services and in addition demonstrate the areas of traffic in which the railways are competitively strong or competitively weak vis-à-vis trucking.

Before examining the structure of railway traffic two qualifications should be noted. First, as representative of total demand for freight transport in Canada, railway traffic is deficient in certain respects, e.g., in short-haul traffic, small shipments, manufactured goods and perishables. Secondly, highways do not extend into all areas of rail traffic so trucking cannot compete for all of it. At the same time, this volume of traffic solely dependent on rail transport is not a dominant factor and has declined as highways have been extended into such areas.[1]

With these qualifications, demand for transport services as exemplified in railway traffic may be fruitfully examined. It should be emphasized, however, that demand in this sense involves preferences for various bundles of transport services at various prices. In general, where competition flourishes the prices (or rates) tend to correspond to the values (or costs) of the various bundles of services supplied. It is in this context that the competitive demand comprised in railway traffic can best be examined here.[2] This implies that on traffic on which the railways have long-run competitive cost advantages, plus services equal to trucking, prices will be such that shippers will continue their preference for rail transport. On traffic involving prices and services on which trucks have a competitive advantage, shippers will tend to demand truck services.

On this basis it is possible to set out the broad categories of traffic for which shippers may tend to continue to demand rail transport. The analysis of relative costs and services by rail and truck, examined in previous sections of this report, provides the information for this. That analysis showed, on the basis of railway services and prices (based on potential costs) that shippers might be expected to have a clear preference for rail transport on such traffic as the following:

1. Heavy-density traffic that moved in trainloads over long distances, especially large volume, bulk, heavy-per-unit-of-space, machine-loaded traffic.

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[1] A considerable volume of primary mineral and forest products may, however, continue to depend solely on rail services for many years because highway facilities are lacking.

[2] It is commonly stated that railway pricing retains substantial vestiges of above-cost rates on high-valued traffic and below-cost rates on low-valued traffic, based on the traditional "value-of-service" rate policy. This may have tended to shift demand from rail to truck transport on the high-rated traffic and leave the railways with an increasing proportion of low-rated traffic—an increasingly unprofitable trend for the railways. The extent of this influence has not been examined here. It would require a special study.

2. Traffic on which time, i.e., speed and frequency of delivery, was not a critical factor in transport services.

3. Traffic on which close supervision of quality and condition (i.e., refrigeration) was not essential, that is, non-perishables.

4. Traffic on which claims for loss, theft or damage were unlikely to be significant, that is, products of low value, of sturdy construction and not requiring careful handling.

Shippers' preference for trucking services would lie mainly on the other end of the spectrum:

1. Small, short-haul shipments.

2. Traffic requiring special service and supervision in both long and short hauls, especially high-valued products.

3. Traffic on which speed and frequency of delivery are important to shippers.

4. Low-density traffic.

These shippers' preferences provide the means for assessing the demand structure comprised in railway traffic. They point up the areas of intensity in the pattern of competition between truck and railway.

These may be illustrated by the components of current railway traffic and by the trend in volume of each component. The component proportions of railway traffic for 1960 are shown below together with the change in each from the 1946-50 period:

	1960 Carloadings, per cent of 1960 total[1]	*1960 Carloadings, per cent of 1946-50*[2]
1. Grain and grain products	12.4	88.4
2. Fresh fruits and vegetables	1.0	58.8
3. Livestock, meats and products	1.8	48.2
4. Other farm and food products	2.2	93.2
5. Pulpwood	3.4	61.9
6. Woodpulp and paper	6.6	111.8
7. Lumber, timber and plywood	5.5	100.6
8. Other forest products	2.5	100.0
9. Ores, concentrates and refined metals	11.5	239.3
10. Coal and coke	5.5	60.4
11. Fuel oil, petroleum and gasoline	8.2	132.8
12. Mineral building materials (stone, etc.)	5.9	101.7
13. All other non-metallic minerals	4.4	221.7
14. Primary iron and steel	2.0	91.2

	1960 Carloadings, per cent of 1960 total[1]	1960 Carloadings, per cent of 1946-50[2]
15. Autos, machinery and parts	2.4	100.0
16. Fertilizers	1.2	116.1
17. Other manufactures and misc.[3]	11.7	151.3
18. Merchandise L.C.L.	11.8	47.5
TOTAL	100.0	93.1

[1] DBS, *Carloads of Revenue Freight on Canadian Railways.*

[2] Freight car capacity increased from an average of 44.83 tons in 1946-50 to 51.08 tons in 1959 but most of this increase was in ore cars, i.e., from 1955 to 1959 average ore car capacity rose from 63 to 79 tons.

[3] Includes piggyback carloadings. With piggyback excluded, 1960 carloadings of "Other Manufactures and Misc." were 96.2 per cent of 1946-50.

In the main, it may be observed that the traffic components showing the greatest decline from 1946-50 are those for which demand for trucking services was strongest[1]—i.e., fresh fruits and vegetables, livestock and products, pulpwood and merchandise L.C.L. In other cases—for example, autos, machinery and parts; other manufactures and miscellaneous—rail carloadings have increased much less than the increase in Canada's output of these products.

Yet the railway traffic for which trucking competes the strongest was, at most, only about one-third of total rail carloadings by 1960. The main components of rail traffic, close to 66 per cent, were centred in the heavy, bulk-handled, trainload commodities, in which rail transport had significant advantages:

	Per cent
Grain and grain products	12.4
Forest products (ex. pulpwood)	14.6
Ores, concentrates and refined metals	11.5
Coal and coke	5.5
Fuel oil, petroleum and gasoline	8.2
Mineral building materials	5.9
Other minerals (non-metallic)	4.5
Primary iron and steel	2.0
Fertilizers	1.2

Most of these bulk commodities also required a fairly long haul (grain products averaged 763 miles; forest products, except pulpwood, 795 miles; coal and coke, 324 miles; fertilizers, 417 miles).[2]

Overall this would indicate that by 1960 the railways were exposed to fairly strong competition from trucks on roughly one-third of their traffic and to relatively less competition on the other two-thirds. But this interpretation should not be pressed too far. It should not be presumed from this

[1] The decline in coal and coke carloadings is an exception. This decline is related primarily to the shift in demand from solid to liquid fuels.

[2] 1958, *Waybill Analysis.*

that the railways will be increasingly certain of retaining their remaining traffic volume as trucking presses them closer toward hauling only the traffic on which they have a theoretical cost advantage. If the railways were capitalizing more fully on their potential cost advantages they might expect trucking competition to peter out eventually. But there were too many indications that the railways were falling far short of this to have such expectations. This was indicated by the sharply increased railway deficits in 1960; by their difficulties in improving rail operating efficiency rapidly enough to stem the shift of traffic to trucks; by their purchase of large trucking subsidiaries in recent years; and by the general air of pessimism and uncertainty in the industry.

At any rate, it had become clear by the early 1960's that the railways had already been brought to a critical juncture by the continuing and probably increasing erosion of rail traffic by trucking. It had apparently reached a point where the future of traditional rail operations was clouded by serious uncertainty and was probably in jeopardy.

In these circumstances, it seemed likely that the trucking industry, having substantial opportunities for technological improvements still opening before it, might well encroach further on future rail traffic than their relative cost potentials alone would seem to warrant.

Organization of Railway Competition

The extent of this competitive threat to the railways was only becoming clearly apparent by the early 1960's. Trucking encroachment on railway traffic had been increasing for more than a decade before that, but the sharp shift from rail to highway came mainly after 1957. By 1960, this loss of traffic together with the downturn in economic activity starting in the third quarter of that year, showed the seriousness of the railways' position.[1]

Both major railways had begun modernizing their plant, operations and services after World War II, but progress in this was not pressed forward until the late 1950's. By 1960, they had completed the change from steam to diesel locomotion; rolling stock had been improved; automated classification yards had been developed and were well advanced in construction;[2] signalling equipment had been improved; mechanized track maintenance had been introduced; data processing was begun; and advanced communications equipment was installed. These were mainly technical changes developed over a decade or more and effective primarily in improving the operating efficiency and lowering costs of rail transport. Much of this improvement was in those operations related to traffic on which the railways have their major cost advantages. In particular, it improved the efficiency of bulk trainload movements substantially.

Changes designed to improve the services to shippers were slower in coming. Most of them were in the late 1950's. Their delay seems attributable partly to a failure by the railways to recognize early enough the increasing significance of service in the new competitive environment and partly to the great difficulty encountered in directing the organization of the railways more toward a service approach.[3] Many of the needed improvements in services involved substantive changes in long-established modes of organization and in operations which had become firmly entrenched by tradition and regulation. Where conditions like these exist, the gains from improvement ordinarily have to be more amply demonstrated and the modifications more thoroughly tested, than might be expected in the normally adaptable trucking industry. No doubt because of this, much of the effort devoted by the railways to

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[1] The 1960 Annual Report of the CNR states, p. 4, "The experience (the Company's financial record for 1960) served to highlight the necessity for pressing forward with programs designed to mould the System into an instrument better able to adjust and respond to both the prevailing business climate and the shifts and new challenges of a highly competitive transportation market".

[2] These electronically controlled hump yards were expected to reduce the time required to make up freight trains by 75 per cent.

[3] "The very nature of the railway as a service industry, plus the magnitude of its operations, contributes substantially to its lack of resiliency in responding to changing conditions." Extract from the Annual Report of the CNR, 1960, p. 4.

modernizing their service competition has gone into experimentation and testing designed to appraise the gains and difficulties and to familiarize their organization with the necessary modifications of established procedures.

By the early 1960's it was evident that for many important services the railways were still in this trial stage. This applied to local merchandising services, containers, fast through (highball) freight service and others. Piggyback service had advanced further than this but was not yet being exploited fully.

Only in their purchase of trucking firms, especially from 1958 on,[1] had the major railways moved rapidly and substantially forward in providing improved service. This shift into highway transport, of course, implied that they did not expect standard rail services to compete effectively with trucking for certain types of traffic in future. This apparently applied also to rail-owned piggyback service, because in 1957 both railways opened piggyback service to for-hire trucking firms.

Most of these innovations concerned with services were designed particularly to meet the growing competition from trucks. It is with their potential in this respect that this study is particularly concerned. The most significant of these competitive innovations were piggyback, containers, agreed charges, railway purchases of truck lines and merchandising services.

Piggyback

Piggyback service involves using a railway flatcar for transporting highway trailers or other containers on line-haul operations and using a highway tractor for pick-up and delivery. In the main, this trailer-on-flatcar (TOFC) operation is a practical measure designed to capitalize on the dual advantages of using trucks for P & D and railway for line-haul.

Starting about 1952, the railways began providing piggyback service using rail-owned trailers (called Plan II). Growth of this TOFC service was slow but in the fall of 1957 the CNR and CPR extended TOFC service to for-hire trucking firms (called Plan I). From 1957 to 1960 the number of trailers carried on piggyback increased rapidly. TOFC carloadings climbed from 3,932 cars in January, 1958, to 16,288 cars in April, 1960.[2] From the latter date, however, piggyback loadings began to level off and in October and November, 1960, loadings were below the same months in 1959. In the first four months of 1961, they averaged 12,379 cars a month, 0.1 per cent below the same period in 1960.[3] Part of this check in piggyback growth

[1] The CPR took up its option to purchase Smith Transport in 1958.

[2] Statistics are available only from 1958.

[3] Total rail carloadings in this period fell more than piggyback. As a result, TOFC rose from 4.4 per cent of total carloadings in January-May, 1960, to 4.9 per cent in January-April, 1961.

can be attributed to the general decline in freight traffic that followed the slackening of economic activity in 1960. But there were also clear indications, as shown below, that the growth of piggyback was likely to be less rapid in future even when economic activity had returned to normal.

Several features of the recent growth of piggyback support this prospect by demonstrating that part of the growth may have been attributable to factors other than any unique long-run advantages of piggyback service:

1. Growth in piggyback from 1957 was largely in the carriage of for-hire trucking trailers. By 1959-60, rail owned and operated TOFC was still only 20 to 25 per cent of total piggyback carloadings and had grown relatively little since 1958.
2. About half the total piggyback carloadings in Canada in 1959-60 were for movements between Montreal and Toronto. This major movement may be explained partly by the deficiencies in highway facilities between these two major industrial centres, especially in the vicinity of the Quebec-Ontario border, and partly by the more attractive rates offered to truckers on this route relative to other routes.
3. The purchase by the railways of trucking companies, mainly since 1957, has enabled part of their highway traffic to be shifted to piggyback. This addition to TOFC traffic was expected to be relatively secure for the railways. It may comprise one-third or more of total for-hire piggyback.[1]

These features suggest that piggyback service may expand less rapidly in future, especially where new or improved highways make road transport easier, as is expected within a few years on the Montreal-Toronto route.

Yet it is necessary to explore the nature of piggyback service beyond its growth pattern in order to assess its potential significance in competition between highway and railway transport. It has substantial advantages over standard box car service for L.C.L. and other high-valued traffic in speed, lower claims and handling costs (TOFC can save four handlings relative to freight shed box car service, two handlings relative to team track operations). Investment in terminals and facilities (involving only ramps, trackage, holding space for trailers and a supply of flatcars equipped with a trailer hitch) is low, about ten per cent of the investment for standard box car terminals. TOFC is relatively profitable to the railways at present rates[2] provided there is sufficient volume for regular trainload, terminal-to-terminal movements.

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[1] In the main, the truck lines purchased by the railways continued to operate as independent for-hire carriers.

[2] In its Annual Report for 1960 the CNR reported, an eight per cent increase in TOFC tonnage over 1959 gave the Company a 23 per cent increase in revenue.

These major advantages in costs and profitability, over box car service, seem likely to encourage the railways to divert to piggyback as much as possible of their present box car traffic that is now threatened by independent for-hire trucking. This diversion might be made through rail-owned piggyback, through rail-purchased truck lines now operating as relatively independent for-hire carriers, through encouraging Plan I piggyback for the wholly independent trucking firms or through encouraging Plan III for shippers owning their own trailers.[1] But, in fact, the scope for this kind of diversion to piggyback is fairly limited under current conditions.

This is because the conditions under which piggyback can be profitable are relatively limited. Its profitability depends to a very large extent on volume and on the rates that can be established.

Looking first at volume as a factor in profitability, it may be apparent that for piggyback service to capitalize most fully on its cost and service advantages over box car operation and, at the same time, meet truck competition most effectively, it must operate on the basis of regular full TOFC trainloads moving largely non-stop from terminal to terminal. This regular volume movement is necessary to compete with the speed and service by highway. It is necessary also to minimize piggyback costs to the railways. Less than trainload movements are costly. For example, to hold up the dispatch of a TOFC until it can be attached to another scheduled passenger or freight train is both costly and time-consuming and ordinarily much slower than direct truck service. Similarly, drop-offs at stations intervening between terminals must be largely eliminated to maintain speed of delivery comparable to highway. This was no doubt the reason that piggyback service in Canada was, in 1960, still confined to less than 35 terminal cities.[2]

This means that piggyback tends to be limited to volume (i.e., trainload) movements and that centres between terminals will have to be served by highway transport. It also means that TOFC service will tend to stimulate highway trucking as a feeder service.

Turning to rates, thus far the rates established for piggyback service, except perhaps on the Montreal-Toronto route, do not appear likely to stimulate large volume TOFC movements in competition with highway service. The rate on for-hire trailers between Montreal and Toronto was 61 cents a cwt. (minimum loading of 34,000 lbs.)[3] or approximately 3.58 cents per ton-mile (highway mileage). Independent truckers using this service must add to this their extra costs for delivering and picking up the trailer

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[1] Plan III started only in March 1961, when some shippers of chemicals began piggybacking their own trailers.

[2] The larger industrial centres have several TOFC terminals.

[3] CTC Freight Tariff No. 38D, January 4, February 4, 1960. The rate for rail-owned trailers, taking into account P & D charges, was equivalent to this for-hire rate. In most cases, the TOFC for-hire rate increases much more rapidly than highway costs per mile as the load rises above the minimum weight of 34,000 pounds.

at the terminals and for the time lost in doing this. Against these costs, it may be recalled, truckers all-inclusive line-haul costs were 3.53 cents a ton-mile in short-medium-haul operations.

On the longer haul from Montreal to Winnipeg the TOFC rate works out to 6.6 cents per ton-mile, while the line-haul costs of long-haul highway operations were only 2.94 cents a ton-mile. On short hauls the TOFC rates tended to be considerably higher. Between Montreal and Ottawa, for example, they were $1.09 a cwt. or 18 cents a ton-mile.

There are some other competitive disadvantages of piggyback relative to trucking. One that may be important to shippers is the loss of personal service ordinarily provided by the truck driver. For example, for perishables the highway driver is able to give continuous attention to maintaining appropriate refrigeration or air conditioning.[1] In the case of piggyback, the railway does not provide protective services against heat and cold while refrigeration, if used on a trailer, must be of an approved type of battery-operated equipment.[2]

Since 75 to 80 per cent of total piggyback carloadings are provided by for-hire trucking firms and close to 50 per cent by independent for-hire truckers, the value of TOFC service to these operators is most significant for its future success. In the survey of major trucking firms it was possible to obtain information with which to appraise this value to for-hire trucking. Almost all firms in the survey used piggyback but they used it primarily for dry freight rather than perishables. The major advantages of piggyback reported by trucking firms were:

1. Its convenience and benefits in special circumstances, i.e., when highway facilities become inadequate, for peak load conditions when too few tractors were available, for extra heavy or large dimension loads, or in "frost law" periods.
2. It enabled operations to be expanded with a smaller investment.[3]
3. It permitted Sunday movements.
4. It might reduce licensing costs.
5. Mileage by rail may be much shorter than by highway, e.g., Edmonton to Vancouver.
6. It was useful for rebalancing trailers among terminals.
7. It might give less exposure to accidents (though insurance rates showed no evidence of this).

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[1] It is common for the recording meters to be located where they can be observed by the truck driver in the cab.

[2] CTC Freight Tariff No. 38D, February 4, 1960.

[3] There were some complaints that truckers without route franchises were using piggyback services and that loads above provincial weight limitations were being carried. Reports indicated the railways looked on these as provincial responsibilities.

8. Risk of snow or ice conditions on the highways might be shifted to the railways.

On the other hand, these same firms reported the following major disadvantages:

1. TOFC was too costly especially when account was taken of the extra costs of delivering and picking up trailers at the piggyback terminal (often up to 10 or 12 miles or more from truckers' terminals). Costs (or rates) were particularly high for short piggyback hauls and for loads above minimum weights.
2. Truckers risked becoming too dependent on piggyback service and thereby becoming vulnerable to railway dominance.[1] In case of a railway strike, truckers could then do little to fill the gap.
3. Piggyback service from shipper to consignee was slower than highway. It required extra time in delivering and picking up trailers at the terminal and in holding loaded trailers until the train was scheduled to leave or had a full trainload of trailers.[2]
4. It was more costly and difficult to schedule dock and P & D operations with a large influx of trailers at a fixed time. With highway operations these auxiliary services could be scheduled to spread over the whole day while piggyback bunched them in the morning and evening to fit train schedules. Twenty-four hours can be lost if a piggyback train is missed.
5. TOFC schedules are not always suited to truckers' needs.
6. Piggyback provides no control and supervision of refrigeration.
7. Truckers required more trailers for piggyback than for highway operations.
8. A large part of the trucker's costs became fixed and these costs were not subject to his ingenuity and innovation in reducing costs as highway expenses were.
9. Truckers lost some control over the speed and flexibility of handling their freight.

The survey indicated that, after three years of for-hire piggyback, much of the original enthusiasm had given way to hard-headed calculation of the net gains and losses of TOFC. It was clear that large-scale use of

[1] "Once the truckers are tied to piggyback, the railways are in control", was the statement of one large firm.

[2] This may not be a serious difficulty where overnight service is given, so long as the TOFC train arrives at destination terminal by seven or eight a.m. On longer hauls, e.g., Toronto to Winnipeg or Edmonton, the delay may be more significant.

piggyback had become less attractive to most independent trucking firms. By 1960, several firms had become doubtful enough of its advantages to carry out special studies of comparative costs, TOFC versus highway. Relative costs on several routes (Montreal-Toronto, Toronto-Ottawa and Toronto-Windsor) were examined. On all of them highway service showed a significant over-all cost advantage.

A careful review of the truckers' appraisals shows that while most firms saw definite advantages in piggyback for meeting peak or other special load conditions and for easing investment costs during expansion, they planned to use TOFC for these purposes rather than to meet their regular day-to-day needs. The exception to this was where highway facilities were still inadequate. All independent firms stated they did not intend to expand their use of piggyback because of its net disadvantages. Even those firms now heavily dependent on Montreal-Toronto piggyback, because of inadequate highway facilities, reported they continued to send at least 15 to 20 per cent of their loads by highway to ensure they did not become wholly dependent on TOFC. Several of these stated that when the Montreal-Toronto throughway was completed (expected by 1965) they intended to ship by highway only. A reduction in piggyback rates could influence this trend, because the higher cost of TOFC had become a significant factor in their evaluation.

Yet in spite of these disadvantages, it seems clear that piggyback will continue to grow, though at a slower rate than it did from 1957 to 1960. For non-perishable freight on which speed and special services en route are not critical factors, its growth could be steady and substantial, rising in a few years to 10 per cent or more of total railway traffic. But how rapidly it will grow depends to a large degree on whether rate policies are adopted which promote its expansion. The above appraisal has been based on rates remaining as they are. But current rates on most routes make piggyback costs higher than costs by highway and services may be less advantageous than by highway. Current rates also discriminate against heavier loads,[1] for which piggyback is particularly well suited. Changes in these rates could stimulate the growth of piggyback and change the above outlook substantially. In early 1961, however, there was no indication that the piggyback tariffs would be so altered.

Containers

The possibility that containerization may be used extensively by the railways to meet the growing competition from trucks has received much

[1] This discrimination in piggyback rates may be designed by the railways to discourage the loading of piggyback trailers beyond the provincial highway weight limits. At the same time, incentive rates designed to promote heavier loading of box car freight were being extended by the railways.

attention in recent years. Yet progress in this direction is still marked mainly by experiment and demonstration. Nevertheless, it has become clear that the role of containers in freight transport will expand. But there has been an evident difficulty in appraising their competitive potential. Much of this difficulty lies in the need for subtle distinctions in the definition and application of containerization.

In a broad sense, containers may be defined as anything capable of holding goods. Thus containers may range from ships and box cars through special shipping cases to the cardboard cartons in which products are packaged at the plant. This whole range of containers has been involved to some extent in the modification of carrying facilities that has occurred in recent years to meet better the needs of industry and to suit the changing conditions of transportation. But in terms of truck-railway competition, the distinction is more subtle than this. In this case, the type of use or purpose of the container is the significant consideration. Basically, containers may be said to be of two primary types or applications. The most important type of the two is the general purpose container suitable for wide general use—the demand here is for a container that is mobile and versatile in carrying a wide range of traffic both ways, that can be fitted in with other modes of transport, and that can be readily kept under control because it is continually being registered as active. In this general purpose type would be included ships, box cars, semi-trailers and such.

The other primary container type is for specialized uses, that is, containers specifically designed to provide the particular conditions for transport required by certain products or certain carriers. These conditions may call for containers smaller or larger than general purpose containers; special refrigeration; special protection from damage, loss or theft; special shapes, special loading and unloading devices and so on. These specialized containers are ordinarily less versatile in range of freight carried and in interchangeability between carriers than general purpose containers. They also encounter other handicaps: difficulties of obtaining return cargo, extra costs and responsibility in returning empty containers, problems of keeping accurate records of container inventories and locations, and such.

In Canada both the general purpose and specialized types of containers are being used along with a few that range in between these two primary types.[1] Of the general purpose containers, the most versatile is the truck semi-trailer. It is mobile. It can move by highway, rail or water. It can be delivered to the shipper's dock, left there to be loaded by the shipper, sealed by the shipper, refrigerated or handled according to the shipper's instructions, hauled directly to the consignee by highway or piggyback and

[1] In the U.S. a much wider variety of containers has been used. Rail piggyback carriers, in particular, have developed numerous specialized types, many of which are not interchangeable between carriers.

returned loaded without cost for return to the original shipper. For general versatility, mobility and adaptability the semi-trailer, as it is used in Canada, has major advantages over other standard containers like box cars, ships, pipelines or aircraft. Perhaps the best evidence of the recognized suitability of the semi-trailer as a standard container is the decision of all Canadian railways to adapt their piggyback service to carrying highway semi-trailers almost exclusively. This wise decision was made after a diverse range of piggyback container types had been made available in the United States.[1] Because of it, there has been little demand in Canada for what is called "a standard container" such as there has been in the U.S.

This suggests there is little possibility of the semi-trailer being supplanted soon in its central role as a standard container. In Canada the railways have, in the main, not attempted to supplant it.[2]

In special containers, however, the competition has been keener. Here the object has been to fit the container to the special needs of the shipper in terms of ease of handling; of protection from damage, theft or loss; of special refrigeration; of special dimensions and such. In general, the value of the commodity must be relatively high to warrant the extra costs and inflexibilities of special containerization.

In numerous instances, trucking firms have taken the initiative in developing these special containers, as noted above. Their efforts to provide special services to shippers have led to development of special tankers for fuels, chemicals and flour; special refrigerated trailers for perishables; special cattleliners and others. More recently they have developed a two-unit trailer to handle L.T.L. shipments. There was no indication that they were behind the railways in developing special containers. The evidence pointed rather to the railways' efforts to develop containers that might enable them to compete more effectively with the standard and specialized services already established by the truckers. For example, specially insulated and refrigerated boxes for shipping fresh fish were developed when it was found that standard reefer icing and lack of supervised refrigeration by rail left much to be desired in maintaining the quality of the product.

This demand for special containers is likely to expand in future. But there are fairly clear indications now that the trend toward special containers will be tempered by considerations of versatility and the back-haul advantages of standardization.[3] This is already evident in the development of containers for ships. The earlier efforts to develop wheelless containers for

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[1] In the U.S. this diversity of equipment with its lack of interchangeability is now looked upon as the major obstacle to the growth of piggyback service there. See, for example, *Piggyback and the Future of Railroad Transportation,* John G. Shott, Washington, 1960.

[2] Efforts in the U.S. have, on the other hand, been clearly directed toward this end.

[3] Several trucking officials noted the large numbers of containers piled obsolete in fence corners in the U.S. as evidence that over-specialized containers had proven unsatisfactory.

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close stowage in the hold appears to be giving way to the use of semi-trailers which move directly from ship to highway.[1]

One field that might have potential opportunities for containers was being explored in Canada in 1960. This was in overseas shipments. Trucking firms had demonstrated the advantages of direct truck-to-ship-to-truck through-shipments to Europe, both by special containers and standard stowage. Substantial economies in costs and time and a single charge to the shipper were some of the advantages noted.

Overall, the tendency to use special containers will continue to be confined to the higher valued and higher rated traffic. The trend, as noted above, is for such traffic to move by truck and piggyback. Because of this, it may be expected that, in container services, trucks and railways will be on a relatively equal footing in competition, with the advantage, if any, probably favouring trucking.

Agreed Charges

Agreed charges have become one of the most effective weapons remaining to the railways in their competition with trucking. They involve an agreement by the shipper with the railway to ship at least a stated major portion of his freight by rail in return for receiving a special, favourable rate from the railways. Originally established in 1938, they were designed as a special inducement to encourage shippers to ship year-round by rail rather than changing to water or truck services in summer. By 1950, they were being directed more toward meeting truck competition. From 1955, when the application of agreed charges was made easier, the railways extended them rapidly to check the loss of traffic to highway carriers. The tonnage moved under agreed charges rose from 53,000 tons in 1954 to 100,000 tons in 1959. The share of railway revenue from agreed charge traffic has expanded rapidly, rising from 6 per cent in 1954 to 14 per cent in 1958.

Primarily, the agreed charge may be considered as a makeshift rate technique designed to enable the railways to price competitively yet bypass normal procedures for establishing competitive rates. The procedure was simplified in 1955, as recommended by the Royal Commission on Agreed Charges, specifically to permit the railways to use agreed charges more freely in meeting truck competition.

Agreed charges have several important advantages for the railways. They permit the railways to bid low enough to ensure they hold or attract the traffic. By tying the traffic to the railways, they assure to them a definite minimum volume of the traffic involved in the agreements. This facilitates

[1] The relatively high cost of modifying ships' holds to carry containers or trailers seems likely to hold back this "fishyback" development, in spite of the high costs of dock handling, until a more effective container has been more definitely established.

railway planning and operations. They also assure a more stable year-round volume, with seasonal variations smoothed out, and this also reduces railway costs. They may both expand and stabilize traffic sufficiently to permit regular trainload movements and thus offer substantial reductions in costs.

At the same time, agreed charges hold some disadvantages for the railways. To attract or hold traffic, rates may often have to be reduced to the point where net revenues become very low. The railways' service disadvantages relative to trucks indicate it may be increasingly necessary to set agreed charges at or below all-inclusive truck costs to be competitive. Even then, agreed charges may not always be effective in retaining the traffic for the railways. In some cases, they involve higher costs to the shipper for blocking and loading box cars, etc., and truckers reported these were significant enough to persuade some shippers to prefer truck services. Agreed charges can be applied most effectively to bulk freight. They are more difficult to adapt to the needs of shippers concerned primarily with L.T.L. shipments, so such L.T.L. has continued to shift to trucking services.

To truckers, in general, agreed charges were a serious threat because they could be used to take away a substantial and sustaining share of their traffic volume. It had become necessary to avoid too great dependence on bulk or volume traffic that might be subject to agreed charges. This prevented specialization in bulk traffic and tended to promote diversification. Agreed charges appeared to have injected a substantial and perhaps excessive measure of uncertainty into the for-hire trucking industry. Some truckers claimed certain agreed charges were set below all-inclusive rail costs and this constituted unfair competition. Yet others indicated that since many agreed charges cover only from 75 to 95 per cent of the shipper's total volume most of them still leave, in the main, all the traffic that any one trucker could handle from these large shippers.[1]

There was evidence in the survey that the trucking industry retained considerable advantage on certain traffic in spite of agreed charges. Cases were reported of agreed charges that had to be very much lower than truck rates in order to attract shippers. In some cases, e.g., dressed meat from Western Canada, it was reported that meat packers preferred truck services (especially their supervised refrigeration) rather than agreed charges at a much lower rate. Improved highways and the reported tendency for the provinces to raise highway load limits when agreed charges threatened the competitive position of trucking was also indicated to have helped trucking firms to meet agreed charge competition.

The strength of the agreed charge as a competitive technique appears to lie chiefly in its combination with the bargaining power that railways

[1] Most agreed charge contracts provided that 75 to 100 per cent of a shipper's traffic must move by rail.

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already enjoy as the major transporter of large volume traffic. Faced with having to ship most of their bulk traffic by rail in any case, shippers may be reluctant and limited in their opportunities to bargain for a rational division of their traffic according to the relative rates and services offered by rail and truck. Under these circumstances their value as a long-run competitive technique may tend to be unstable. Yet it seems clear that without the use of agreed charges the railways' competitive position vis-à-vis trucking would have deteriorated much more rapidly than it has since 1955.

Trucking firms stated they had lost much profitable traffic to the railways through agreed charge agreements. Their complaints emphasized that agreed charges as used by the railways tended to eliminate competition, that at least some of the rates did not cover rail costs and that there was no means of appeal by the trucking industry against discriminatory agreed charge rates.

Yet so long as the railways are required to fill the major transport role in the Canadian economy, it may seem necessary to permit them to use extreme measures to hold traffic rather than allow them to decline as rapidly as they otherwise would have. It seems evident, however, that the growth of trucking relative to rail transport will continue in spite of agreed charges. If it does, as the railway traffic for which trucks compete declines in volume, rail costs may be expected to continue rising and eventually establish a floor price below which agreed charge rates will not be profitable. By 1960-61, there were indications that the railways were already approaching this point on lines where traffic volume was relatively low.

Railway-Owned Trucking Services

A more recent technique in railway competition is the development or expansion of railway-owned trucking services. Most of the growth in this field came after 1957. As noted above, the CPR, with its acquisition of Smith Transport in 1958, became the largest operator of trucking services in Canada. The CNR delayed its action longer, and only in 1960 moved strongly into this area of competition, especially in long-haul trucking.

In general, truck lines purchased by the railways have continued to operate as separate for-hire carriers as subsidiaries of the railway company. In most cases, while they continue to serve the route for which provincial franchises were held, their organization and financing appears to be undergoing a process of gradual integration with the other highway services owned by each railway and, to a lesser extent, with the purely rail operations. The competitive techniques used have been confined primarily to piggyback[1] and

[1] For example, a substantial part of Smith Transport's traffic may now be seen moving by CPR piggyback since Smith was purchased in 1958.

to direct highway competition. There is very little indication that they can or will be used effectively as a feeder service for rail box car operations. For the major part of rail traffic, especially the bulk, machine-loaded traffic carried in trainloads direct from shipper to consignee, there is little scope for co-ordination of trucking with rail services. On the rest of the traffic, extra handlings are required in using trucking as a feeder service for box car movements. Because of this, rail-owned trucking can compete with independent highway operators on non-bulk freight more effectively through piggyback or direct highway hauling than as a feeder service.

It is probably too early to assess clearly which of these two directions, piggyback or direct highway, will receive the most emphasis in future development of these subsidiary trucking services.

In the developments to 1961, the CPR had tended to emphasize the feeder role, chiefly via piggyback, of their trucking subsidiaries while retaining those highway operations which appeared essential to hold the traffic. The CNR followed a similar pattern in the beginning, especially in its development of "rail-head" piggyback services in the Maritimes and in their limitation of piggyback services from Central Canada to the Maritimes to rail-owned trailers. Yet the CNR's option-purchase of two long-haul trucking firms operating between Central and Western Canada, seems to suggest the intention of this railway to shift more into direct highway operations.

The evidence now building up on piggyback potential suggests that the future trend is likely to be more toward highway operations. In the main, piggyback can compete strongly with direct highway operations only on dry freight, terminal-to-terminal operations, and where there is a relatively large volume of traffic. In these circumstances, it will leave much traffic (perishables, low-density or intervening station traffic, etc.) that must move by highway in any case. Piggyback growth has levelled off. For about half of their TOFC handlings the railways are dependent on independent truckers and they may lose a big part of this as highway facilities improve. Railway-owned TOFC has not kept pace with the growth of trucking. And it may be expected that piggyback handlings by truck lines purchased by the railways will also suffer similar difficulties in expanding their TOFC traffic. In addition, there are, as examined above, many traffic areas where direct highway transport has substantial advantages over piggyback in both services and costs. In total, these features of piggyback versus highway competition may be expected to turn rail-owned trucking more toward direct highway operations to enable the railway complex to compete most effectively.

Yet these trucking subsidiaries of the railways have some significant disadvantages in competing with independent trucking firms. In becoming part of a very large rail-truck complex their flexibility is evidently reduced to some extent even though their operations are largely independent of those

of the railway. To the extent they co-ordinate their operations with those of the railway and its other trucking services, the subsidiaries may also lose some important advantages of small firm decision-making. Some loss of independent initiative by management was evident and this may reduce their ability to compete as effectively in special services as the smaller, wholly independent trucking firms. Finally, evidence of provincial government opposition to the expansion of rail-owned trucking may be a handicap to their expansion.

Offsetting these in part were several important advantages. The railways, as the major large volume transporters,[1] have advantages over smaller independent truckers in bargaining with shippers for traffic. They may use some of these bargaining advantages on behalf of their trucking subsidiaries. They may also be able to direct their subsidiaries toward traffic on which rail box car or piggyback services are having difficulties in competing against independent trucking.

Independent trucking firms showed some concern about this growth of rail-owned trucking. Information obtained in the survey indicated their concern was mainly that this could lead to some degree of monopoly of surface transport by the railways. Several reported losing some traffic to rail trucking because of the extra bargaining power imputed to the railways. But most of them were less concerned with present disadvantages than with future prospects in this respect. Taking account of the handicaps, discussed above, which rail-owned trucking faces in future competition with independent truckers, there may be less cause for concern than the latter anticipated. But future trends in public policy with respect to further purchases of independent trucking franchises and the extension of existing franchises was looked upon as a critical determinant of this.

Merchandising Services

The impact of sharply increased competition during the 1950's from highway transport, pipelines, airlines and, to a lesser extent, water transport, impelled the railways to turn their attention toward improving and co-ordinating their transport services. Such action had become urgent as a result of the rapid technological changes in freight transportation, the demand by shippers for the new and specialized services that were becoming available and the consequent losses of freight traffic by the railways.

To meet this new competition the railways have turned toward improving their merchandising services, i.e., toward specializing their operations, their services and their promotion to fit the local market demands and the particular commodities involved. But the railways' progress in the

[1] For example, many large manufacturers depend on the railways to haul their bulk freight both in raw materials and finished products, which commonly comprises the major volume of their traffic. Only the traffic requiring special services may go by highway.

direction of improvement and co-ordination at the local level has been neither easy nor rapid. This was because, on the one hand, it required a massive reorganization of railway services and management. On the other, it required changing the approach of railway management and workers from a passive to an active philosophy. In organizations as large in scale as Canada's two major railways and with such long established techniques and services, the obstacles to such changes are very great. Much greater than might be expected in the smaller, flexible trucking firms that ordinarily restrict their operations to a limited area or route.

Nevertheless progress has been made. After several years of study both railways are now moving on a broad front. The major features of this reorganization for improvement indicate the range and complexity of the developments envisaged. Steps have already been taken to decentralize the administration of railway operations and to co-ordinate these with the expansion of direct selling as well as the development of new services.[1] The object of this transfer of more administrative control to the area offices from the central headquarters was to improve their competitive efficiency[2] by co-ordinating sales with operations at the area level and integrating rail and truck operations there also.

But whether they have moved far enough in this respect to meet independent trucking competition is still doubtful because the local areas established are in the main substantially larger than those within which most independent truck firms concentrate their services.

But even if these new local areas were the appropriate size, the difficulties of re-aligning the railways' long established chains of authority, of shifting from central to local accounting procedures, and of developing new techniques and services for local handling of freight, seem likely to make the decentralization a fairly slow process. Both major railways have had to give it much preliminary study and testing. Both railways have used the experimental approach rather than an immediate over-all shift into local administration and co-ordination. The CPR has been testing local integration of operations for handling rail, truck, air and sea traffic in British Columbia for some two years, gradually expanding it to cover more points in that Province. The progress and success so far there has indicated this type of integration would be expanded further.[3]

The CNR, having expanded its highway services somewhat later than the CPR, gave more emphasis in the beginning to the "railhead" approach in experimental development. The railhead technique involves using highway

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[1] In July, 1959, the CPR subdivided its eight districts, reporting through three regional headquarters, into 31 operating divisions with four regional headquarters. In 1960, the CNR broke down its three regions, 10 districts and 31 divisions into five regions divided into 18 areas with each area administration having authority for both sales and operations.

[2] CPR Annual Report, 1959, p. 18, and CNR Annual Report, 1960, p. 5 and 6.

[3] CPR Annual Report, 1960, p. 8.

carriers to fan out from a rail terminal, to pick up and deliver freight moved mainly by rail. The CNR has used this technique in the Maritimes in conjunction with piggyback operations since 1959. Its value for improving handling efficiency was noted in 1960 along with plans to extend it in future to other areas.[1]

The over-all task of integrating the transport services provided by the railways is complex and difficult. The railways have indicated it will involve combining their express and L.C.L. services; co-ordinating the scheduling of highway with rail operations; developing techniques that improve the speed and reduce manual operations on handling freight that is transferred between highway and rail services; improving the type and speed of service; developing new equipment and terminals to facilitate integration of rail-truck services; developing new equipment to meet shippers' special requirements; and eventually co-ordinating these local services with transcontinental operations.[2] In a transformation of this magnitude, which the railways have apparently concluded is essential to meet the new competition that has developed,[3] progress must of necessity be slow. The impediments to rapid modification of established techniques as well as the extensive nature of the new techniques to be developed seem likely, in view of progress thus far, to delay completion of the full reorganization until the late 1960's at least.

Until the changeover to local responsibility is completed in each area the railways will be under considerable disadvantage in providing specialized services to shippers in competition with the locally-oriented independent trucking firms.

Trends in Railway Transport

To summarize the foregoing, the railways have made substantial advances in adapting their operations and organization to the new conditions of competition in the transport market. Yet most of their progress has been in improving their efficiency in handling bulk trainload movements (dieselization, automatic classification and signalling, improved rolling stock, etc.). This has strengthened the advantages they already enjoyed on this volume traffic.

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[1] CNR Annual Report, 1960, p. 8.

[2] Both railways inaugurated a fast freight "highball" service between Central Canada and the Pacific Coast in January, 1961, to develop techniques for meeting "the steadily increasing competition in the transcontinental freight hauling". *Keeping Track,* April, 1961, p. 7.

[3] "The ultimate aim of the program is to provide one superior service featuring speed and service and employing the most efficient coordinated use of train, piggyback and highway carrier transport." CNR Annual Report, 1960, p. 8.

Much slower progress has been made in improving services to shippers. And it is in services that the railways have the greatest disadvantages in competing with highway transport. It may require some years to complete the reorganization necessary to bring co-ordinated service competition down to the local level where trucking now has such superiority. In the meantime, rail traffic will continue to be eroded by highway services. In the meantime, also, it may be expected that technological improvement in highway transportation will continue to make further rapid progress, as will be shown in the next part of this report.

Because of this and because of the greater obstacles the railways face in adapting to this changing competitive environment, the railways may be expected to continue to lag behind the smaller scale, more flexible trucking firms in technical and service improvement. The gap seems likely to widen. In other words, taking all these influences into consideration it seems clear that the improvements made or under way in rail transport will retard but not prevent further losses of traffic to highway transport.

These considerations indicate the prospect that standard railway services will in future be confined more closely to carrying only the heavier, bulk trainload commodities. Rail piggyback, while it cannot provide a complete service in competition with highway transport and has significant disadvantages in costs and services, may be expected to expand considerably. TOFC handlings should rise steadily, especially of dry freight, perhaps to ten per cent or more of total rail carloadings. They could rise faster and higher if TOFC rates are more closely adapted to stimulating piggyback services.

Highway operations of rail-owned trucking may be expected to increase. But the growth of these intercity highway operations of the railways may not be as rapid as that of independent trucking because of the inflexibilities that attach to integration of highway and rail operations. Future highway operations by the railways may be affected also by the freedom they are allowed in extending their present franchises and in their purchases of additional truck lines.

Overall, the evidence does not suggest that the competitive strength of independent trucking has been or will be significantly weakened by the railways' progressive improvements. Thus far these improvements have not closed the gap in services rapidly enough to prevent an increasing loss of traffic to independent trucking. Indeed the gap may well widen during the next decade.

The Role of Trucking in Canadian Transport

The foregoing appraisal has indicated the influences that are likely to shape the future role of for-hire trucking in Canada. They may be briefly summarized here.

Short- and medium-haul trucking has grown steadily in recent years and now carries most of the freight traffic within its haul range. Much of its growth has been at the expense of rail traffic, especially in L.T.L. and other high revenue freight. Long-haul trucking, though more recent in development, has shown a remarkable growth particularly in the late 1950's and in 1960. It appears destined to continue this expansion.

The nature and organization of trucking gives it notable advantages over the railways in providing services to shippers. The growth of these trucking services has been paralleled by a growth in shippers' demand for specialized services. In this new service-oriented transport market, railway transport has been falling behind in competition. In addition, losses of traffic to trucking impose a double penalty on rail transport. Because the traffic requiring the most specialized services is commonly the most profitable to carry, the railways have been losing not only the volume of this traffic but also its substantial net revenues. Even in costs the railways have encountered disadvantages in recent years. While they still enjoy substantial advantages over trucking in bulk, trainload, terminal-to-terminal long-distance movements, trucking in turn has major advantages over rail in short haul, small shipment and L.T.L. operations. Between these two extremes the competitive positions are less clearly defined. But highway operations have been steadily expanding in this intermediate area. The most notable feature of this highway expansion has been the growth of long-haul trucking, especially in perishables and in other traffic requiring special services, but also in some bulk traffic. The evidence indicates that in the long run, the competitive advantage is likely to swing more toward trucking in this intermediate area of the Canadian transport market. Supporting this is the tendency of railway costs to increase in the areas of low-density traffic that continue to develop as traffic shifts to highway services. There was evidence the railways were already encountering critical cost difficulties in this respect in 1960.

The marshalling of railway operations and organization to meet truck competition has been delayed by inflexibilities. It is still advancing relatively slowly insofar as improvements in services are concerned. Piggyback appears likely to compete with highway transport mainly on dry freight and then only with some significant cost (or rate) handicaps. Perhaps because of this the railways appear to be looking more toward expansion of their highway subsidiaries than to piggyback or improved box car services as a means of

meeting independent trucking competition. This approach seems justified in view of the limited range for piggyback competition and the disadvantages of extra handlings by box car. This suggests that trucking as a purely feeder service for the railways may have relatively less application than might appear at first glance. The effectiveness of feeder trucking under present conditions is likely to be confined mainly to piggyback and to bulk commodities that can be readily transferred mechanically between truck and box car. At the same time, establishment of joint rail-truck through-rates at more satisfactory levels and with suitable financing arrangements might well open a potential field of traffic which the railways have not yet exploited extensively.

This summarizes the competitive conditions as they had developed at the beginning of the 1960's. Unless there is a significant change in this competitive pattern, the railways will continue to have difficulties in maintaining such a rapid rate of growth and improvement as is expected in trucking. These immediate prospects suggest trucking will continue to draw ahead in the competitive race. Such prospects were confirmed in the plans of firms as reported in the special survey of trucking that was part of this study. They are supported also by the longer run outlook.

Current Outlook for Highway Transport

The survey of trucking firms indicated that highway services were likely to continue to improve relative to rail services and that these service advantages would stimulate further shifts of traffic from the railways. Opportunities in this connection were noted particularly in long-haul trucking. But progress in improving services was also evident in short-haul operations (i.e., 100 to 200 mile hauls) where there was little competition with rail service because trucks already carried virtually all of this traffic.

Recent advances in short-haul movements were directed mainly toward improving the handling and servicing of L.T.L. traffic (e.g., mechanized terminal sorting, split trailer bodies, etc.) and special shipments requiring individualized service. These improvements were providing more or faster service to shippers and, at the time, usually reduced the trucker's handling costs. It was clear that much more could be accomplished in this field and that the efficiency of progressive short-haul operators would continue to improve.

In medium- and long-haul trucking, however, greater opportunities for development and growth were recognized. Several short-haul operators, for example, said their major possibilities for future expansion lay in extending their activities into the area of medium and longer hauls. Trucking firms already engaged in long hauls were the most optimistic of all on the prospects for growth of trucking. Some of these emphasized particularly that competi-

tive opportunities for improvement of services to shippers relative to existing railway services were virtually unlimited, that the key to their growth was in specializing in service to shippers. These long-haul firms suggested that if trucking operators examined shippers' needs and then tailored a mutually satisfactory service to those needs there was much scope for expansion of highway traffic. Examples of immediate potential improvements in long-haul operations were: third-morning delivery in place of current fourth-morning delivery between Alberta and Central Canada as soon as the western Ontario portion of the Trans-Canada highway was completed; direct delivery of truck-loads of dressed meat from packing plants in the West to eastern chain stores; special two-way containers to protect the quality of perishables; bulk liquids in rubber tanks; specialized services to particular shippers; improvements in terminal handling and others.

Along with these improvements in services, the long-haul operators looked for their recent rapid expansion of traffic to continue, particularly in eastbound perishables and other traffic requiring special services.

Prospects for reducing costs relative to the railways were also examined in the survey. As with services, the long-haul firms saw greater opportunities for cost improvement than did the short-haul operators.

Yet the shorter haul operators reported some costs were being reduced and others were expected to be cut in future. Improvements in the quality of tires (partly the change from rayon to nylon) and recapping processes had already cut tire costs as much as 29 per cent since 1959. Opportunities for increasing payloads were still available and being exploited.

Larger and lighter trailers,[1] lighter and more powerful tractors and sturdier highways were some of these. Prospects were good that such technological improvements would permit substantial reductions in future costs by way of larger payloads.

To some extent, these cost reductions through bigger payloads depended on technology only. In part, they depended on government policy in building more and sturdier highways and bridges, in permitting longer vehicles and larger load limits. Most operators saw steady improvement in these also. Other avenues noted for reducing costs were in more flexible trailers, split trailer bodies, removable undercarriages,[2] and in P & D and dock handling operations.

Against these prospective economies the short-haul trucking operators set expected higher labour costs and possibly some increase in licensing costs.

Long-haul operators, facing a much larger volume of unexploited demand, saw wider opportunities for reducing costs. The increased volume

[1] Many truckers still use 35-foot trailers when they could use 40-foot (e.g., in Ontario) or longer than 40 feet in other provinces.

[2] In some provinces only the undercarriage is licensed and ability to switch undercarriages may enable licensing costs to be reduced.

of traffic in prospect was expected to reduce their overhead costs, would permit quantity purchases of repairs and supplies at lower prices and would reduce equipment servicing costs and P & D costs. Other cost savings were in prospect in dock handling and claims (e.g., by new air cushioning methods for trailers).

Long-haul operators looked forward to substantial cost reductions through improvements in their equipment. Use of more powerful tractors with shorter motors and blocks,[1] use of lighter and stronger materials (e.g., plastics) in construction, elimination of front axles, and nitrogen gas refrigeration, were noted as improvements that were expected to reduce future costs by increasing the payload, even with highway weight limits unchanged. Improvements in trailers were also expected. These would involve use of lighter materials, more trailers utilizing the full lengths and heights permitted, and more uniformity in provincial regulations (on lengths, heights, clearance lights, licensing, etc.) that would tend to bring all provinces nearer to current average requirements in these regulations.

The improvements now possible in trailer equipment plus those available in tractors could increase the average payload by several tons without any change in existing regulations. Less certain but still a clear possibility was the likelihood that public policies would continue to permit increases in payloads as well as promote other economies as they have in the past. Most significant was the expectation that weight and length limits would be raised as highways were improved.[2] Additional savings on licensing costs, clearance lights, adjustable wheels, and other regulatory costs were expected as the provinces progressed toward fuller reciprocity in Canada and with near-border states. In general, long-haul truckers looked for their total costs to be decreased considerably in future. Less concern about the prospects of higher labour costs was evident among long-haul firms than short-haul operators, probably because drivers were not organized to the same extent in long-haul operations.

Viewing the over-all cost outlook, the long-haul operators saw their cost position as likely to improve relative to railway costs. Short-haul operators saw fewer opportunities for cost reductions and little prospect of significant reductions relative to rail costs.

These differences in cost outlook and traffic prospects were reflected in their plans for expansion in the future. All long-haul firms had plans for

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[1] Wider use of V-8 engines was suggested as contributing to this.

[2] This expectation was confirmed to a degree by the increase in weight limits in Saskatchewan in April 1961, enabling a substantial increase in loads on the Trans-Canada highway route between Alberta and Central Canada. On length limits the 50-foot maximum in Ontario seems to give most concern to truckers.

immediate or continued expansion. The short- and medium-haul firms saw less likelihood of a general expansion of their traffic[1] but reported numerous plans for developing new traffic lines.

Specialized long-haul firms planned to expand as much as 25 per cent a year. They saw substantial opportunities for growth in traffic requiring special services, in perishables including livestock, in L.T.L. and in overseas shipments. Their plans included carrying a wider range of commodities, increasing their traffic volume and extending their route coverage.

On the other hand, it was clear that the non-specialized long-haul operators had found the opportunities in long-distance trucking less attractive than their specialized confrères. This group of firms, the largest in scale of operations, was engaged mainly in short-medium hauling but included long hauls as part of the complete service they endeavoured to provide. These firms planned to expand their medium-haul operations (particularly the range beyond 300 miles) where, unlike the short haul, there was still substantial room for growth. Some of these firms expressed the view that in the long run they saw the greatest advantages for trucking within haul ranges of 400 to 600 miles rather than in longer hauls. It seemed evident, however, that their lack of specialization in long-haul operations may have been a sufficient handicap to lead to this conclusion.

Plans for expansion by short- and medium-haul operators included, for example, overseas shipments,[2] more L.T.L., some extension into longer haul traffic, serving new resource areas such as are being opened up in the "Roads to Resources" program and in handling bulk products like paints where the shipments can be loaded in split trailer sections by the manufacturer and each section delivered intact to its particular consignee.

Long-Run Outlook

Considering the above appraisal of its potential in services and costs as well as the industry's plans for expansion, the for-hire trucking industry

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[1] This response of short- and medium-haul operators was, in part, a reflection of the recognition that they already carried almost all of the traffic suitable for highway in their haul range. It reflected also the slowdown in the Canadian economy which had resulted in a downturn in their traffic for several months just before the survey was made at the end of 1960. This downturn did not occur in long-haul traffic.

[2] Geared as they are to providing special services, truckers have found a fertile field in overseas transport. Standard overseas service was reported to be too complex for the average shipper to handle conveniently. It ordinarily involved several agencies and several handlings and much lost time. After a few test shipments, truckers had found profitable opportunities in overseas shipments direct from shipper to consignee (in some cases on one bill of lading). These opportunities were starting to be exploited in 1960 by both long- and short-medium-haul firms. The economies in time and cost of having shipments handled throughout by one agency were reported to be large. Additional savings in crating, etc., were gained by using split trailer containers loaded by the shipper and carried intact to the overseas consignee.

seems destined for continued growth. Part of this future growth may be expected through drawing traffic from the railways, part from new traffic. For short-haul trucking, not much growth at the expense of rail traffic may be expected since trucking handles virtually all of this traffic already. In medium-haul operations, a steady expansion seems indicated to the point where a substantially larger share of this traffic will be moving by highway. For long-haul trucking, now carrying a relatively small share of the total traffic, prospects are for a continued rapid growth. This tendency for growth in the medium- and long-haul traffic means a substantial part of it will be in interprovincial hauling.

These prospects depend, of course, upon more than the demand for trucking services and the industry's plans to expand them. They will be affected also by public policies respecting highway construction, load limits, reciprocity and other regulations and programs. In this respect, the plans of the trucking industry for future growth were premised in the main on highway conditions as they were in 1960. They did not take into account any improvements beyond those they had enjoyed in the past. Aside from the expectation that important gaps in the Trans-Canada highway would be completed by 1964 or 1965, new highway construction did not come into their plans.

Yet it may be evident that public policies, primarily provincial policies, will be an important element in the future growth rate of trucking. Virtually since the beginning of highway transport, the growth of the trucking industry has been treading heavily on the heels of progress in highway construction and regulation in Canada. It still is. The development of long-haul trucking in Canada was and still remains primarily dependent on United States highway facilities. Gaps in highway facilities between Montreal and Toronto have made it necessary to use piggyback services to handle part of the growth in demand for trucking. Gaps in the Trans-Canada highway—in Ontario, British Columbia, Quebec and the Maritimes—continue to restrain freight movements along this route.

Lack of uniformity in licensing, weight and size limits, clearance light requirements and other regulations continue to restrain the development of extra-provincial trucking.[1] For example, the development of long-haul trucking between Central and Western Canada turned, in the beginning, primarily on the Province of Alberta holding the door open for development. Alberta, virtually alone among the provinces concerned, allowed new firms to enter freely for extra-provincial transport, and by special efforts promoted reciprocity in licensing and other regulations with intervening states and

[1] Trucking firms reported that provincial transport boards were hesitant in supporting expansion of extra-provincial trucking because of federal-provincial jurisdictional problems. The railways were reported as opposing such expansion also, either directly or through their trucking subsidiaries.

provinces. The national transportation service provided by these long-haul firms still depends to a major degree upon the good offices of that Province.

Nevertheless, progress is being made among the provinces in co-ordinating their regulations and licensing arrangements to facilitate interprovincial movements. Progress in provincial highway construction has also been notable—in completing the Trans-Canada highway, in building wider and sturdier throughways for heavy traffic volumes and in building intercity and feeder highways. Yet here it may be noted that the emphasis is ordinarily given, as would be expected, to serving the transport needs of the provincial economy rather than the national economy.[1] In these circumstances, it may not be surprising that the gaps in highway facilities occur frequently at a distance from the industrial heartland of a province, often in the vicinity of the boundary between provinces. Thus it may be expected that co-ordination of highway facilities on a national basis is likely to continue to depend on federal participation such as in the construction of the Trans-Canada highway.

Overall it was expected that highway facilities would improve steadily but that they would continue to lag relative to the volume of traffic which demand for highway transport indicates the trucking industry may be called upon to carry.[2]

Outlook as the Transition Develops

While the growth of trucking may be less than it might be with more adequate highways and more co-ordination of licensing and regulations, nevertheless its growth is likely to be substantial. This growth will be concentrated more on medium- and long-haul (e.g., interprovincial) traffic than it has been in the past. And a part of this growth will be based on traffic that is attracted from rail services.

But further losses of traffic by the railways could well have extensive repercussions on rail transportation in Canada. Already in 1960-61 the railways were facing most serious financial difficulties. The relative inflexibility of the railways in adapting their services to meet competition in the new service-oriented environment seemed likely to prevent them regaining the ground lost to trucking. The increasing extent of unprofitable traffic areas, low-density branch lines and uneconomic handling services, appeared

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[1] Nevertheless, there is increasing recognition among the provinces of the need for a national highway system. For example, Provincial Treasurer Woodrow Lloyd of Saskatchewan recently stated that development of a national highway system to take responsibility for all international and interprovincial highways was desirable. See *The Globe and Mail,* June 21, 1961, p. 19.

[2] Trucking firms expected steady improvement in highway construction resulting in larger payload and lower costs and improvements in regulations and reciprocity, though their plans for expansion did not include these expectations as a factor.

to be approaching the point where further traffic losses could soon prove disastrous by their effects in raising costs. The alternatives open to the railways would seem to suggest speeding up the modernization of their merchandising services and divesting themselves of their most unprofitable operations. Such a withdrawal of rail services from low-density and unprofitable operations would permit the smaller sized and more flexible trucking services to serve these areas, normally at lower costs.

While each such withdrawal of rail services would need to be appraised on its individual merits, it may be evident that the capacity of the trucking industry to absorb the additional demands for services is limited under current conditions. Deficiencies in highway facilities, low capacity bridges in most areas, limitations on interprovincial movements as well as obstacles in adapting highway transport to meet the gaps in national services, all serve to restrict its ability to meet such additional demands for services.

Altogether the outlook suggests that highway transport is not likely to be able to take up its eventual role in provincial and national transportation as rapidly as the railways may need to shift it to them because of rail cost difficulties. This indicates that the next five to ten years may be in the nature of a transition period. During this period the railways may be forced to remain in financial difficulties because Canada is not yet well enough equipped with highways, regulatory institutions and associated services to enable trucking to ease the railways' burdens of uneconomic operations as they become acute. It seems likely that within a few years the competitive difficulties of the railways will have become more clearly evident. When that time comes, the need for more highway and other public services, particularly for interprovincial traffic, may also become clearer.

Problems of Public Policy

The foregoing analysis has shown that for-hire trucking in Canada has established itself on a firm foundation for continued growth. In the beginning its growth was primarily in short-haul or intra-provincial transport. This was the necessary result of the conditions under which for-hire trucking developed—limited highway facilities, low capacity and undependable road equipment, and a railway-oriented industrial economy. With the changes in these conditions, for-hire trucking has overcome many of its early handicaps in competing with rail transport and has steadily extended its range of competition. Its expansion in the phase of local operations may now be said to be virtually completed. While it will undoubtedly increase and improve its services further in short-haul operations it will gain little traffic from the railways in this area because it already carries almost all of it.

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In recent years, as the dominance of for-hire trucking in short hauls became established, its growth has tended to reach more and more extensively into longer haul traffic including interprovincial and transcontinental movements. Already it has become firmly established as a strong competitor of the railways for a substantial volume of this traffic. Its future growth at the expense of rail traffic will be substantial on medium-haul traffic but it appears likely to be most rapid in long hauls where its specialized services are in widening demand in competition with the railways.

This rapid and substantial shift toward longer highway hauls has caught public policy singularly unprepared. Most of this longer haul growth occurred in the last five years, i.e., since 1956. Public policy had been based on the belief that such a development was unlikely to occur.[1] When it came, it brought difficulties not only for the railways but also for the administration of public transport policy.

Because of the nature of the early development of highway transport on a local service basis, it is not surprising that it appeared practical and desirable at that time to establish its administration wholly as a provincial responsibility. Until recent years this appeared to be the only reasonable alternative. With the volume of extra-provincial traffic relatively small it was also quite effective.

The volume of such traffic carried by for-hire trucking was still relatively small in 1954 when the Federal Government delegated its share of responsibility over highway transport to the provinces. In February of that year, the Privy Council had ruled that federal jurisdiction included interprovincial and international transport plus any intra-provincial undertakings incidental thereto. This jurisdiction was immediately delegated by the Federal Government to the several provinces where it has been administered since then.[2]

This delegation of powers caused little difficulty for the provinces at the time because it merely confirmed what they had been doing in the past. But the rapid changes in Canadian transportation since then have sharply increased the difficulties and burdens of these responsibilities. Looking ahead, it seems clear that the difficulties of these responsibilities will multiply in future. This seems assured by the prospects for continued rapid growth of longer haul trucking and for the continued withdrawal of railway services

[1] For example, as late as 1956 a report prepared for the Royal Commission on Canada's Economic Prospects clearly indicated there was little likelihood of such growth.—"Beyond that point (1,500 miles) there is considerable doubt as to whether or not line-haul motor carrier operations are profitable or practical." See A. F. Hailey in *Transportation in Canada*, J. C. Lessard, Appendix A, p. 149.

[2] All provinces, except Newfoundland, where there is virtually no extra-provincial traffic involved, now assume responsibility, by concurrent regulations, for these federally delegated powers.

that may be expected to accompany this. In fact, the competitive and financial difficulties of the railways are already at a point where this withdrawal may move very rapidly in the next half decade.

The responsibilities imposed on provincial jurisdictions by this rapid and continuing transition in national transportation services are substantial. In effect, provincial governments are being pressed by events to provide a co-ordinated national highway service to fill the growing demands of shippers and the gaps developing in railway services. This involves provision of highway facilities to link the transportation services from province to province. It also involves regulating highway and piggyback operations between provinces although provincial jurisdiction does not extend beyond each province's borders.

The federally-assisted Trans-Canada highway is not yet complete. By the time it is finished (now planned for the end of 1963) it is expected to be then well short of the expanded requirements. In the central provinces of Ontario and Quebec substantial distances of these increasing highway requirements are outside the central industrial areas. Highways traversing these less industrialized areas are alternatives to continued dependence on U.S. highways to link the regions of Canada with trucking services. Prospective growth in interprovincial traffic may well burden United States highways unduly and make them a less certain avenue for such traffic. Moreover, the obligation for the provinces to regulate interprovincial traffic does not include the obligation to provide highways for such traffic, nor are their obligations likely to be so extended. Accordingly, a co-ordinated highway system for interprovincial traffic would imply federal participation.

The growth of interprovincial and international traffic has also rendered its regulation more difficult for the provinces. Regulation has been made complex also by the purchase of truck lines by the federally-regulated railways and by the growth of railway piggyback. All of these have raised conflicts of regulatory policy between provinces and interprovincial carriers and between provincial and federal regulations. Difficulties have developed in working out suitable reciprocal licensing, load limits, franchises and other regulations among provinces. If these difficulties continue, the tendency in Canada may be for shippers to turn from for-hire towards private trucking as they have in the United States.

Problems of policing the licensing and load limits for piggyback trailers have also apparently weakened provincial control. A conflict between national and provincial services was arising out of the regulation of truck lines purchased by the railways. Numerous other such complex problems were developing.

As long-haul trucking expands in its interprovincial operations these conflicts and difficulties of the provinces may be expected to grow also. They

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are likely to become increasingly burdensome. In the long run, it seems no more likely that the provinces can carry the full responsibilities of developing and regulating large-scale interprovincial trucking operations effectively than it was possible for them to carry the burden of railway building and regulation they attempted 50 to 70 years ago.

At the same time, the importance of a co-ordinated and comprehensive transportation system for the growth and maintenance of the Canadian economy on a national basis has been recognized. This has been established as a principle of national policy since before Confederation. The growth of longer haul transportation and the inroads made by trucking in general on the established national transportation system of railways has now reached the point where the national system, to give complete service, includes highway as well as rail services.

Apparently, this expansion of highway transport into the interprovincial field has brought with it a new awareness of the role of federal co-ordination. The brief presented to the Royal Commission on Transportation by the Province of Quebec stated for example "Transportation policies are largely national policies . . . The Government of the Province of Quebec stands ready to co-operate with the other provinces and the Federal Government in the development of transportation policies which will best serve the interests of all Canadians".[1]

Viewed from the federal role, the rapid growth of for-hire trucking has made the co-ordination of a national transportation policy more complex than it was when major dependence for overland transport was on the railways. As the role of the railways declined relatively, federal policy problems have resolved into two major aspects. On the one hand, national policy has been faced with problems related to the adaptation of the railways to the new transportation environment with all that this entails in curtailment of unprofitable services and reorganization of operations. On the other hand, it is confronted with problems of making it possible and practical for highway transport to fill the gaps thus created by this withdrawal of railway services.

The complexity of these federal problems has been multiplied by the rapidity of the recent growth in longer haul trucking and the lack of public awareness of how seriously this growth had undermined the position of the railways and will continue to so undermine it in future.

The transition period will pose significant problems in federal transport policy. The task of revamping long established legislation, regulations and procedures to enable the railways to adapt to their new and changing environment will be one of these. On the other hand, the Federal Government has been so little involved with highway transport that it has not been concerned either with policy in this field, or, to a sufficient extent, with the sub-

[1] Submission by the Province of Quebec, p. 65-66.

stantial range of information that would be needed to develop an effective federal policy. It is notable that the first recognition of the trucking industry in federal legislation came only on June 9, 1961.[1]

Another federal handicap may be the absence of a unique organization of trucking firms that is concerned primarily with problems of national or interprovincial highway transport.[2] Lacking such a body it may be difficult for the Federal Government to have clear recommendations on policies from the interprovincial operators involved. Yet it was evident that both provinces and trucking firms were becoming convinced that the degree of co-ordination required in interprovincial trucking would eventually involve more federal participation.

The magnitude and complexity of the task of making it possible for the railways and for-hire trucking to carry out their new sharing roles in national overland transportation effectively and, at the same time, of preventing the resulting dislocations from causing undue burdens on shippers in the various regions, all suggest substantial federal initiative and participation.

Undoubtedly the costs of the eventual transition will also be large. Already the national government is carrying a substantial share of the railways' financial difficulties. Other costs to provincial or federal governments may be seen arising as a result of the curtailment of railway services or the increasing demand for more interprovincial highway facilities. Additional local highways and the strengthening of many local bridges may be required where branch line rail service is withdrawn.

All this adds up to a substantial task in both policy and financing. The pressing urgency of the railways' plight seems likely to make the federal task even greater. The adaptation of railway legislation, regulations and institutions, complex though this may be, may be the most readily solved of the two tasks.

Pending fairly wide-spread support from both the provinces and the trucking firms concerned, the fitting of trucking into the national transportation system at the federal level may need to move fairly slowly. In the meantime a great deal more information could be obtained on it, so that as the demands for federal co-ordination develop they may be most effectively implemented.

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[1] Statement of Hon. Léon Balcer, Minister of Transport, House of Commons Debates, p. 6124, June 9, 1961, in the debate on a private member's Bill to allow a national trucking association or a province to appeal to the Minister or Board of Transport Commissioners against agreed charges that are unjustly discriminatory. The Bill had not at that time received approval of the Senate.

[2] As presently organized both local and interprovincial trucking firms are joined together into provincial associations. These provincial associations have formed a central organization, the Canadian Trucking Associations Inc., as their national body.

AVERAGE COSTS PER HIGHWAY MILE

LONG- AND SHORT-MEDIUM-HAUL TRUCK OPERATIONS, CANADA[1]

	Long haul		Short and medium haul	
Line-haul costs:				
Tractor operation:				
Tractor drivers' wages	8.44		7.19	
Maintenance	3.48		4.15	
Tires	1.81		0.73	
Fuel and lubricants	6.86		5.76	
Tolls	0.92		....	
Road expense	0.26		....	
		21.77		17.83
Depreciation	3.61		2.44	
Licences	1.91		0.84	
Insurance	0.72		0.23	
		6.24		3.51
Semi-trailer:				
Maintenance	1.84		1.46	
Tires	0.71		0.47	
		2.55		1.93
Depreciation	2.87		3.31	
Licences	0.18		1.47	
Insurance	0.06		0.16	
		3.11		4.94
Total line-haul costs excluding overhead		33.67		28.21
Overhead applicable to line haul		7.52		7.13
Total line-haul costs		41.19		35.34
P & D and dock costs:				
Direct costs	2.67[2]		23.95	
Overhead	1.65[3]		11.99	
Total P & D costs		4.32		35.94
Total costs per mile		45.51		71.28

[1] Average costs for firms surveyed.
[2] For long haul, P & D costs plus their share of overhead was included in this item.
[3] Overhead in this case includes terminal and dock costs.

A SURVEY OF PRIVATE TRUCKING IN CANADA

Aside from Dominion Bureau of Statistics data which covers only recent years, there is very little information on the development and growth of private trucking in Canada. For this reason a recent survey[1] made by the Canadian Industrial Traffic League (CITL) is of particular interest. The CITL is an association of some 550 shippers across Canada, many of them among the largest users of transportation services.

The CITL survey, made in the summer of 1961, showed 72 per cent of its member shippers used private trucking and shipped 34.2 per cent of their freight by this means. Most of this development of private trucking has been in the past two decades—63 per cent of the private truck fleets were started after 1945. The carrying capacity of these private trucks had expanded substantially, particularly in the 1950's. From 1956 to 1961, for example, 65 per cent of these fleets had increased their capacity, the average increase being 48.6 per cent. Future expansion is expected to be even more rapid—55 per cent of these private fleet owners planned to expand capacity, by an average of 25 per cent within the next two years, that is, from 1961 to 1963.

The reasons shippers use private trucking, as given by the CITL firms, emphasized the importance of services and costs. Ninety-three per cent of the firms put lower costs (41 per cent), better services to customers (41 per cent) and more flexible service (11 per cent) as the major advantage of private trucking. Next in order of importance were the advantages of better control of loading and unloading, better control over transportation, faster transit time, less loss and damage and advertising benefits.

Some 27 per cent of the private truck fleets were either partly or wholly leased. This points up another feature of the survey, its indications of the growth of "do-it-yourself" commercial trucking. This do-it-yourself trucking is an outgrowth of truck leasing. It enables individuals or firms to obtain trucks to be operated by the lessee with no capital outlay. There was evidence that this type of leasing operation was stimulating private transport and would be increasingly important in future.

Overall, the report indicated that private trucking had reached a stage where it could become an immediate alternative if the services and rates of for-hire carriers should depart very far from the services and costs that private trucking could provide.

[1] Apparently the survey was stimulated by references to the importance of private trucking made in the first volume of the Report of the Royal Commission on Transportation, March, 1961, page 24.

Piggyback Transportation in Canada

by

D. W. Carr and Associates

OTTAWA 1961

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Piggyback Transportation in Canada

Introduction

Transportation in Canada has been changing from a general purpose system to one of specialized services. In the past all types of commodities were shipped by rail—oil, coal, cattle, manufactured goods in crates and so on. But today the new transport media are specialized. Each carries a particular kind of freight more effectively than railways or other methods can. Trucks take the high-value, high-rate traffic that demands speed and directness. Lake and seaway carriers take much of the low-cost, mass transportation business. Pipelines are most specialized of all, carrying only liquid and gaseous fuels in one direction only.

To the railways, in this new competition for traffic there remains a large volume of bulk freight like coal, iron ore, wheat for export, and such, as well as a substantial volume of general freight traffic (mostly manufactured and miscellaneous). This railway traffic is mainly freight which requires fairly long hauls. But in recent years a significant part of this longer haul traffic has been eroded away by the competition of trucks. The railways in Canada have made tremendous efforts to improve their transport services and to develop ways of meeting this competitive threat to this, their most profitable, freight traffic. The development of piggyback is one of the most promising of these new railway methods.

Piggyback operations consist of using a highway tractor and trailer to pick up freight, transferring the loaded trailer to a railway flatcar for line-haul transportation between origin and destination, and delivering the goods by highway tractor from the piggyback terminal. This is trailer-on-flatcar (TOFC) service, more commonly called piggyback.

To place it in perspective, piggyback should not be viewed as a special or isolated development but as one of a number of innovations adopted by the railways in recent years to cut their operating costs and improve freight services.[1] It has been viewed by the railways as one of the brightest spots in their over-all modernization program. Its growth is said to have enabled them to stop losses of traffic to trucks and to recover some of the traffic they had already lost.

The basis for the growth of piggyback lies in the increased demand by shippers for improved and specialized transport services and the defects

[1] Most railway improvements have been by way of cost-reducing innovations.

that have become apparent in traditional railway methods[1] of servicing freight shipments. Such railway methods have become too costly (freight handled through sheds, box cars, etc., may require four to six handlings or more compared with two for trucking); too slow (switching and classification at origin and destination plus dropping off carloads here and there at intervening points, commonly take as much or more time than the line haul); too impersonal and generalized (damage, loss and pilferage are reported to be greater than with piggyback or highway transport); and lacking in those special services designed to meet the particular requirements of individual shippers (railways have established mainly general purpose freight services and schedules with the object of meeting the average needs of all shippers and shippers have accordingly had to adapt to these railway services rather than *vice versa*).

These disadvantages of railway freight services have resulted in a large and growing loss of general freight traffic to the trucking industry. These service disadvantages have been sufficiently important to some shippers to outweigh rate advantages that lower line-haul costs by rail may offer them. The result: such shippers have been turning more and more toward trucking services.

Piggyback opened the way for the railways to stop some of this loss of traffic to trucks. Low line-haul rail costs are reported to be the main factor supporting this new opportunity for rail competition. The opportunities in piggyback lie primarily in combining the speed and service advantages of trucking with the low line-haul costs of rail transport. In other words, to use highway transport for pick-up and delivery and trains to haul the trailers from terminal to terminal.

Yet the appraisal of the possibilities for TOFC service to compete extensively with the specialized services provided by trucks or other transport requires careful analysis. Early enthusiasm for rail piggyback has stemmed to a large extent from its many advantages over conventional box car methods. It has not always been recognized that piggyback has relatively few advantages and some major disadvantages relative to highway trucking, its strongest competitor.[2] In the railways' drive to improve efficiency and service in the face of low profits and strong competition from truckers and the Seaway, piggyback has promised to play an important part in the over-all

[1] This applies more to the methods used for handling class freight traffic than to bulk commodities like grain, coal or ore, which are commonly loaded and unloaded by efficient mechanical means and, being moved mainly by the trainload, can proceed directly from origin to destination without costly delays en route in passing through classification yards, dropping off cars at intervening points, etc., such as occurs with general freight traffic.

[2] It will be shown below that piggyback has some substantial disadvantages in competing with truck transport. These limitations are not always recognized. See, for example, Meyer, *et al.*, p. 150, "The basic difference between truck and piggyback movement is the differential between rail and truck line-haul expenses". This overlooks some very important considerations.

railway improvement.[1] This is because most railway improvements have been focussed on reducing costs, e.g., dieselization, new classification yards, etc., while piggyback was expected primarily to fill the widening gap in services between box car and trucking, thus meeting the most important weakness in competitive rail operations.[2]

Another consideration is that conditions for piggyback in Canada differ markedly from those in the United States. Its potential in Canada must accordingly be assessed independently in many respects of the experience in the United States.

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[1] This is illustrated also in *The Economics of Competition in the Transportation Industries*, by J. R. Meyer, *et al.*, Cambridge, 1959, p. 110, where it states, "Piggyback is . . . a new concept in railroading. (It) allows the radical simplification of railroad operations, switching on the ground, highway movement on low traffic density pickup and delivery operations, and the bypassing of freight sheds and team tracks. Unless these new practices are adopted, piggyback will be simply a more expensive and colorful version of conventional railroad transportation".

[2] Professor A. W. Currie has suggested that piggyback, now the focus of attention, is only one part of the over-all revolution that is taking place in the whole transportation picture at this time. See *Canadian Transportation*, April, 1959, p. 35. To the railways, piggyback has seemed of key significance because of this vista of improved service, competitive with trucks, that it opens to them. See, for example, N. R. Crump in *Monetary Times Annual*, 1959, p. 114.

Development of Piggyback in Canada

Growth of Piggyback

Piggyback is not new in Canada. It started as early as 1858, when the Windsor branch of the Nova Scotia Railway opened. Piggyback provided 15 per cent of that Railway's revenue in the beginning. At that time, farmers' wagons were lashed on flatcars to carry produce from Windsor to Halifax. The horses were carried on the same train in box cars.

Today the power units usually stay at home. Only the highway trailer is hauled by rail. This modern type of TOFC service began in Canada almost a hundred years later, in 1952, and then only in a small way. In the United States, on the other hand, some railroads had begun developing it in the late 1930's. The Canadian development started with the two railways carrying their own trailers in 1952. It grew slowly until the fall of 1957. In October of that year the CPR and CNR began carrying trailers for highway common carriers. From that time on, growth in piggyback has been rapid.

Records of this growth are available from January, 1958. These show that, starting with the 3,932 railway flatcars loaded in piggyback service in the first month of record, January, 1958, loadings rose to 16,288 cars a month by April, 1960, but declined thereafter and had not again recovered that level by May, 1961.

RAILWAY CARS LOADED IN PIGGYBACK SERVICE IN CANADA, BY MONTHS[1]

	1958	*1959*	*1960*	*1961*
January	3,932	7,811	9,471	10,502
February	3,861	7,772	10,674	10,809
March	5,435	10,513	13,126	13,632
April	7,047	11,965	16,288	14,576
May	6,978	11,549	14,801	15,472
June	6,163	11,832	13,605	
July	6,439	12,210	12,581	
August	6,401	10,595	13,491	
September	7,693	12,365	13,778	
October	7,964	13,036	12,935	
November	7,269	12,407	12,265	
December	7,927	11,874	11,884	
Total	77,109	133,929	154,898	
Monthly Average	6,426	11,161	12,908	

[1] Dominion Bureau of Statistics.

This remarkable fourfold increase during the first two and a half years of record raised piggyback in Canada to a relatively more important role than it had achieved in its much longer period of development in the United States. By the end of 1960, TOFC loadings comprised almost 4.3 per cent of total railway carloadings in Canada. In the United States they had reached only 1.82 per cent of total carloadings.

	Canada[1]			*United States*[1]		
Year	*Total cars loaded*	*TOFC cars loaded*	*TOFC per cent of total*	*Total cars loaded*	*TOFC cars loaded*	*TOFC per cent of total*
	(thousands)			*(thousands)*		
1955	4,065.6	....	....	37,636.0	168.1	0.45
1956	4,402.8	....	....	37,844.8	207.8	0.55
1957	4,036.8	....	....	35,500.1	249.1	0.70
1958	3,771.0	77.1	2.00	30,222.1	276.8	0.91
1959	3,854.9	133.9	3.50	31,014.5	416.5	1.34
1960	3,635.4	154.9	4.26	30,439.6	554.2	1.82

[1] Source: Dominion Bureau of Statistics and Association of American Railroads, Car Service Division. Some allowance should be made for the greater proportion of piggyback flatcars which carry two trailers piggyback in the U.S. than in Canada. Thus, in trailers handled, the above estimates of U.S. carloadings might under-estimate U.S. piggyback by 10 to 20 per cent relative to Canada's loadings. This would, of course, leave Canada still well ahead proportionally.

In Canada, piggyback service is provided by the CPR and the CNR while the PGER provides service for truckers' trailers only. In the United States, 50 railroads, in 50 states, and operating 86 per cent of the railway tracks, had piggyback service in 1960.

The CPR has become the largest piggyback carrier in the world. It carried 24,000 trailers on flatcars in 1957, 62,000 in 1958 and 101,600 in 1959.[1] In 1960, CPR piggyback made a small gain over 1959. The CPR was providing about two-thirds of the piggyback service in Canada in 1960 but there was some evidence in that year that the CNR was beginning to gain a larger share of TOFC traffic than it had in the past.

In 1960, about 25 per cent of the total trailers shipped by piggyback were owned directly by the CNR or CPR. The other 75 per cent of the trailers carried by these two railways were owned by for-hire trucking firms including such firms like Smith Transport, which were subsidiaries of the railways. The CNR handled almost as many rail-owned as trucker-owned trailers. But the CPR handled only about one of its own trailers for every

[1] Annual reports, Canadian Pacific Railway. Common carrier piggyback services added $4.5 million to CPR freight revenues in 1958 and 780,000 tons to the freight handled.

five carried for trucking firms. Thus the CPR carried much the largest share of trailers for trucking companies, but the CNR carried the largest share of rail-owned trailers.

Progress in piggyback in Canada has been substantial for the short period of its development. This growth has been more rapid in Canada than in the United States. Opportunities for its development, especially to serve for-hire truckers, have been greater and the planning of its development has been somewhat more effective in Canada. The nature of this planning and organization is examined next.

Routes Served

Although piggyback services were not inaugurated in Canada until 1952, independent trucking companies had tried unsuccessfully from the late 1930's to negotiate piggyback arrangements with the two major railways. In almost every case such negotiations involved the Montreal-Toronto run where so much highway congestion existed.[1] Until 1957 the railways declined to offer such piggyback service.

In 1952, the CNR and CPR began carrying their own trailers between Montreal and Toronto. Full information on the numbers of trailers hauled in this period is not available but the evidence indicates that the growth of this service was quite slow.

In the meantime, the CNR joined with the CPR in making a survey of the volume tonnage on the highways together with a study of rail versus truck costs. Apparently primary attention in the study was given to "the most prolific area of highway (rail) competition in Canada . . . notably between Toronto and Montreal".[2]

In 1957, two events occurred which stimulated TOFC both in numbers of routes covered and in trailers hauled. One was the purchase of Smithson's Holdings Ltd., owner of the largest trucking business in Canada, by the CPR. The other was the application by eight major trucking firms to the CPR and CNR for piggyback services between Montreal and Toronto.[3] The transfer of Smithson's Holdings to the CPR was completed in 1958. It gave the CPR established truck services from Manitoba to Nova Scotia, some of which could be shared with piggyback. The application for TOFC service by the eight for-hire trucking firms was approved on August 1, 1957. This TOFC service

[1] See *Transport Release* of Canadian Trucking Associations, Inc., August 2, 1957.

[2] See H. B. Parr, assistant freight traffic manager, CNR, in *Railway Age*, January 13, 1958, p. 16.

[3] Smith Transport, a subsidiary of Smithson's Holdings Ltd., was one of the eight. The others were: Asbestos Transport, Direct Winters Transport, Husband Transport, Inter-City Truck Lines, Kingsway Transports, Motorways (Quebec) and Reliable Transport.

began on October 8, 1957, and was an immediate and mutual success.[1] Within two years it enabled the CPR to carry more trailers than any railway in the world. CNR for-hire piggyback grew rapidly also.

With this beginning piggyback was rapidly extended by the railways. Highlights of the CNR development indicate the pattern:

July 14, 1958	Piggyback inaugurated between Central Canada and the Maritimes.
February, 1959	For-hire piggyback Montreal-Ottawa-Toronto-London, Port Arthur-Winnipeg.
February, 1959	For-hire piggyback services extended to serve 11 western cities including Winnipeg, Regina, Saskatoon, Calgary, Edmonton and Vancouver.
March 9, 1959	Coast-to-coast piggyback for moving vans with household goods.
March 23, 1959	International piggyback between Toronto and New York and New Jersey jointly with Delaware Lackawanna.
May 15, 1959	Piggyback service between Montreal and Fredericton, N.B.
July 7, 1959	Complete trucks including tractors with trailers carried between Moncton and Halifax.
July 20, 1959	Specific cargoes (e.g., chemicals, etc.) carried in company-owned trailers between Sarnia and Montreal.

The CPR development followed a similar pattern but was somewhat more extensive. Being supported by a very large trucking organization, CPR piggyback grew more rapidly than the CNR.[2] In December, 1959, President N. R. Crump announced that piggyback service covered 6,000 CPR route miles and was available from the Atlantic to the Pacific.[3] At that time it was serving 21 cities. By May, 1960, this had increased to 25 cities. For-hire common carriers were offered CPR piggyback service at the following points—St. John, Fredericton, Aroostook (Maine), Quebec, Montreal, Ottawa, Toronto, Fort William, Dryden, Winnipeg, Regina, Saskatoon, Medicine Hat, Lethbridge, Calgary, Edmonton and Vancouver. Other cities were served by rail-owned piggyback service only.

With its own trailers, the CPR offers piggyback services between Montreal, Toronto, Hamilton and London. In Western Canada, trailers belonging to the CPR subsidiaries Canadian Pacific Transport, Dench and O.K. Valley Freight (operating as for-hire trucking firms), are carried between Winnipeg, Brandon, Regina, Saskatoon, Swift Current, Medicine Hat, Lethbridge, Calgary, Edmonton, Red Deer and Vancouver.

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[1] Assistant general manager W. J. Hines of Kingsway Transports Ltd. called this 1957 agreement for hauling "for-hire" trailers "a mile-stone in Canadian transportation history. It provided benefits to all concerned and showed co-operation is possible." *Canadian Transportation,* August, 1959, p. 37.

[2] Recent purchases by the CNR of several trucking companies will undoubtedly increase piggyback loadings substantially.

[3] *Monetary Times,* Annual National Review, 1960, p. 95-96.

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In total, 84 piggyback routes are operated by the CPR.

The Pacific Great Eastern Railway in British Columbia provides piggyback service between North Vancouver and Dawson Creek for for-hire common carriers.

The greatest growth of piggyback has been in areas where traffic volume was heaviest. By 1960, about 85 per cent of total TOFC loadings were in Eastern Canada and the balance in Western Canada. Nearly half the total loadings were in providing piggyback service between Montreal and Toronto.

Except for the Maritimes, piggyback thus far is mainly an intra-regional service rather than interregional. Of the total TOFC loadings in Central Canada in 1960 (these Ontario and Quebec loadings were 81 per cent of total TOFC handlings in Canada) only an estimated 9 per cent went outside the two central provinces. Similarly, in Western Canada, only about 20 per cent of TOFC loadings there were for destinations outside that region. In the Maritimes about 80 per cent of the 1960 loadings were for destinations outside the Maritimes, mostly to Central Canada. But total TOFC loadings in the Maritimes were a relatively small part of the total for Canada, i.e., about 4 per cent.[1]

Most of the piggyback movements in Canada are concentrated within the central industrial complex included in the metropolitan areas of Montreal, Toronto, Hamilton, Windsor, Sarnia and London. Thus it is mainly a short to medium distance service rather than long haul.

But TOFC service, whether it serves the short-haul intensive transportation needs of a highly industrialized region or the long-haul needs of interregional transport in Canada, is almost exclusively a city-to-city service. As it has been designed it provides mainly trainload piggyback service between industrial cities. It does not serve the intervening stations between these major industrial centres. Thus the CPR with some 6,000 miles of piggyback routes serves some 25 cities.

This terminal-to-terminal service is significant because to the extent TOFC takes over freight traffic from railway box car services it can be expected to expand the role of trucking in the over-all transportation operation. The pick-up and delivery range of feeder trucking has necessarily extended to cover these intervening points. The growth of piggyback has in this way stimulated a related growth in short- and medium-haul trucking. There may be a similar stimulus to long-haul trucking, because piggyback terminal-to-terminal service will give a time and distance advantage to direct truck

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[1] In 1960, the CNR was providing TOFC service out of the Maritimes only for rail-owned trailers. In Western Canada, no rail-owned TOFC service was provided by the CNR but trailers for for-hire trucking firms were carried. The CPR carried for-hire trailers for all regions but its TOFC service with rail-owned trailers was negligible in Western Canada and the Maritimes.

service to areas, surrounding the point of piggyback delivery, which are nearer to the point of origin.

Piggyback Plans

Although piggyback routes and facilities are expanding rapidly, only two of the five well-known United States plans are fully in operation in Canada. This limitation of plans may be partly attributed to the railways owning some of the major trucking companies.[1] Briefly, the five U.S. plans may be described as follows:[2]

- I The railway supplies the flatcars and the service, the for-hire highway carriers provide only the trailer to be shipped.
- II The railways handle their own trailers.
- III Like I, but the trailers belong to private carriers or shippers.
- IV The shipper provides both the trailer and flatcars.
- V Involves joint rail-truck rates that permit the railway or the highway carrier to take shipments originating in, or going to, the other's territory. This plan is more significant for the United States where more interlining is necessary than in Canada.

Plan II under which the railways handle their own trailers began first in Canada in 1952. It grew slowly in the early stages. More recently it was being integrated and co-ordinated into the railways' general merchandising services and its use has been expanding steadily.

Plan I for carrying for-hire trailers has had a more rapid growth in Canada than Plan II and is reported to be making profitable additions to railway revenues. By 1960, it was providing about 75 per cent of the total TOFC service in Canada, with Plan II contributing the other 25 per cent.[3] Plan I is not open to all truckers. So far it has been limited to those truckers with established highway routes between the points served by piggyback. The tariff for Plan I (No. 38D) restricts the service to for-hire trailers of truckers who hold the required licences for the route and who have made prior contracts with the railway companies. In the main, agreements are made only with the larger truckers. Truckers not served have claimed these agreements represent discrimination by the railways, though this has not yet been tested in the courts.

Plans III and IV for carrying trailers owned by shippers are still under study in Canada. A number of shippers have shown interest in making

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[1] See *Canadian Transportation,* January, 1960, statement by A. E. Jenner, manager, piggyback services, for CPR, p. 31.

[2] See Appendix A for a full description of these five U.S. plans. A sixth plan involving use of trailers for L.C.L. shipments has also recently been used in the United States.

[3] Of this 75 per cent of total TOFC service, provided under Plan I to for-hire trucking, about one-third was for for-hire trucking firms owned by the railways.

Plan III arrangements but thus far such movements have been largely trial shipments.

As for the railways, both have had exploratory talks with shippers on Plans III and IV. But both have stated they are highly satisfied with the way Plans I and II are working out. By confining piggyback service to these two plans Canada's railways may hope to serve the whole transport needs of such shippers rather than just the piggyback portion.[1] This appears to be the trend in auto transport operations. The CPR, for example, recently developed a new 40-foot trailer (Car-A-Van) that will carry four new cars outbound and general merchandise on the backhaul. Smith Transport began using it in the fall of 1959 on piggyback service. The auto manufacturers have handled their own transport in the past as a one-way operation. The new Car-A-Van is expected to provide two-way economy by cutting line-haul costs via piggyback and providing a return cargo where highway auto transporters had ordinarily returned empty. A big demand is anticipated for auto shipments to Western Canada, using this service.

With the development of the St. Lawrence Seaway and the purchase by Canada Steamship Lines of Kingsway Transports, Gossett and Sons and Arrow Transit, it was widely expected that "fishyback", i.e., carrying trailers on water transport, would develop rapidly. This plan has not shown much growth yet, however. Part of the explanation may lie in the need to remodel existing ships in order to utilize the stowage space effectively with trailers. Some vessels, chiefly in the United States, have already been modified in this way at considerable expense. Evidence suggests it may be more economical to build the ships especially for receiving trailers and other containers. Not much progress has been made yet in building Canadian ships for carrying trailers or containers but recent developments in U.S. shipbuilding indicate that future construction of package freight water carriers may well emphasize this feature.

Equipment and Facilities

The major features of piggyback equipment and facilities are their simplicity and economy relative to the requirements of conventional freight services. The nature of the operations show this. This is indicated by TOFC operations. Highway tractors haul the trailers to the piggyback terminal and back them up ramps onto flatcars (each track may hold 5 to 12 or more

[1]A major railway problem in the U.S. is the increasing proportion of freight being carried by private shippers in their own or leased equipment. An ICC survey, reported in 1958, showed 201 of 325 manufacturers queried do their own trucking and 40 more planned to do so. It also showed that railways got 24 per cent of the freight transportation dollar and highway common carriers 39 per cent, while 26 per cent went to private, co-operative and contract carriers. *Barron's*, August 4, 1958, p. 3.

cars) (Figure 1). A two-man crew anchoring the trailers can handle up to five such ramps. The loaded piggyback flatcars being directly classified as they are loaded can then be combined into trains, moved to the departure yard and put behind fast freight or passenger locomotives (Figure 2).

Thus the main essentials for a piggyback terminal are a supply of flatcars equipped with a trailer hitch, a rail siding with a simple loading ramp at the end and a parking area. These can ordinarily be installed at relatively low cost. A recent U.S. study compared the installations and costs at the Kearney, N.J., TrucTrain terminal with the standard industrial terminal area at Trenton, N.J. Both handle roughly the same amount of freight. The piggyback terminal included 19,700 feet of track and 15 turnouts (switches). The standard terminal had 185,530 feet of track and 265 turnouts. At current prices, track and turnouts in the Kearney piggyback terminal were estimated to cost $279,039 and those at Trenton $3,031,645, more than ten times as much.[1] In addition a great deal less labour would be required to handle the same freight through the piggyback terminal. These low investment and handling costs for piggyback terminals offer the railways a major opportunity for savings.[2] There may be savings in line-haul costs also.

Piggyback terminals are now being located on the outskirts of cities at points convenient to major highways so the trucking end of the operation can be expedited. So far, end-loading from ramps has been found most efficient. Side-loading, in some cases with fork-lifts, has been tried but efficient and economical containers, flatcars and loading equipment for this method are still to be perfected. Considerable research is being done on this by the railways, however.[3]

In flatcars for piggyback, the Canadian railways have taken a very practical approach, keeping costs low by adapting flats primarily to handle standard highway trailers. As noted below, this was in marked contrast to the U.S. railways' approach.

Both CPR and CNR began by using standard flatcars with the simplest possible modifications—ACF hitch suitable for any highway trailer (Figure 3), guide rails at the sides and a short hinged gangplank at the

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[1] *Brief of Defendant Railroads*, p. 52-59, The Eastern Central Motor Carriers Association, Inc., v. The Baltimore and Ohio Railroad Company, *et al.*, ICC Docket No. 32533, *et al.*, 7/1/59, as quoted in *Piggyback and the Future of Railroad Transportation*, by John G. Shott, Washington, 1960, p. 39-43.

[2] Fixed investment expenses are a major item of cost to the railways. A rough estimate would put about two-thirds of the railways' normal investment in fixed property and one-third in locomotives and cars. About 80 per cent of railway expenses are for property and organization while 20 per cent are for running trains. Accordingly, piggyback offers an opportunity for the railways to cut back in their major cost area.

[3] See A. E. Jenner, manager, CPR piggyback services, in *Canadian Transportation*, August, 1959, p. 32-33.

Figure 1

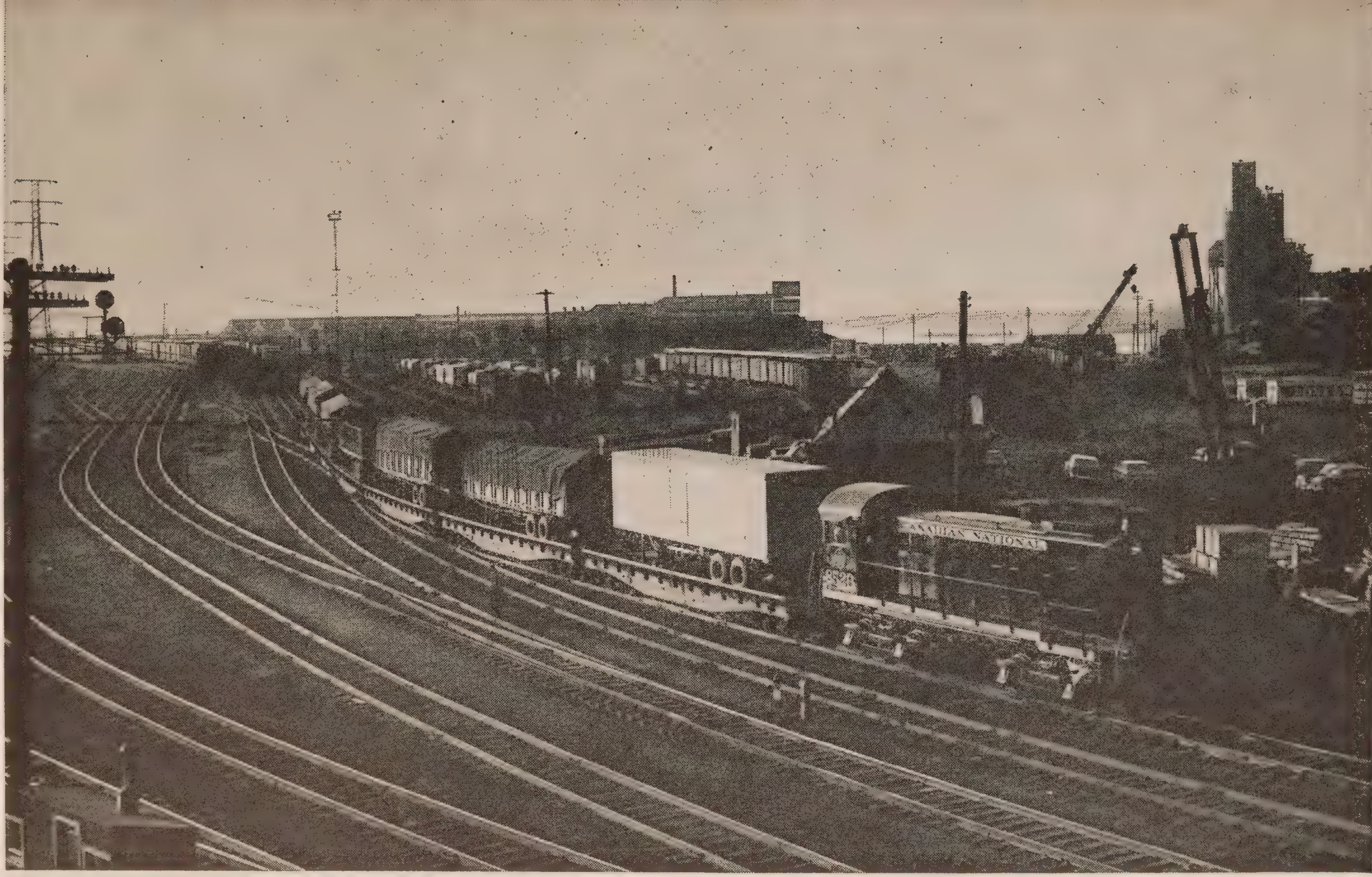

Figure 2

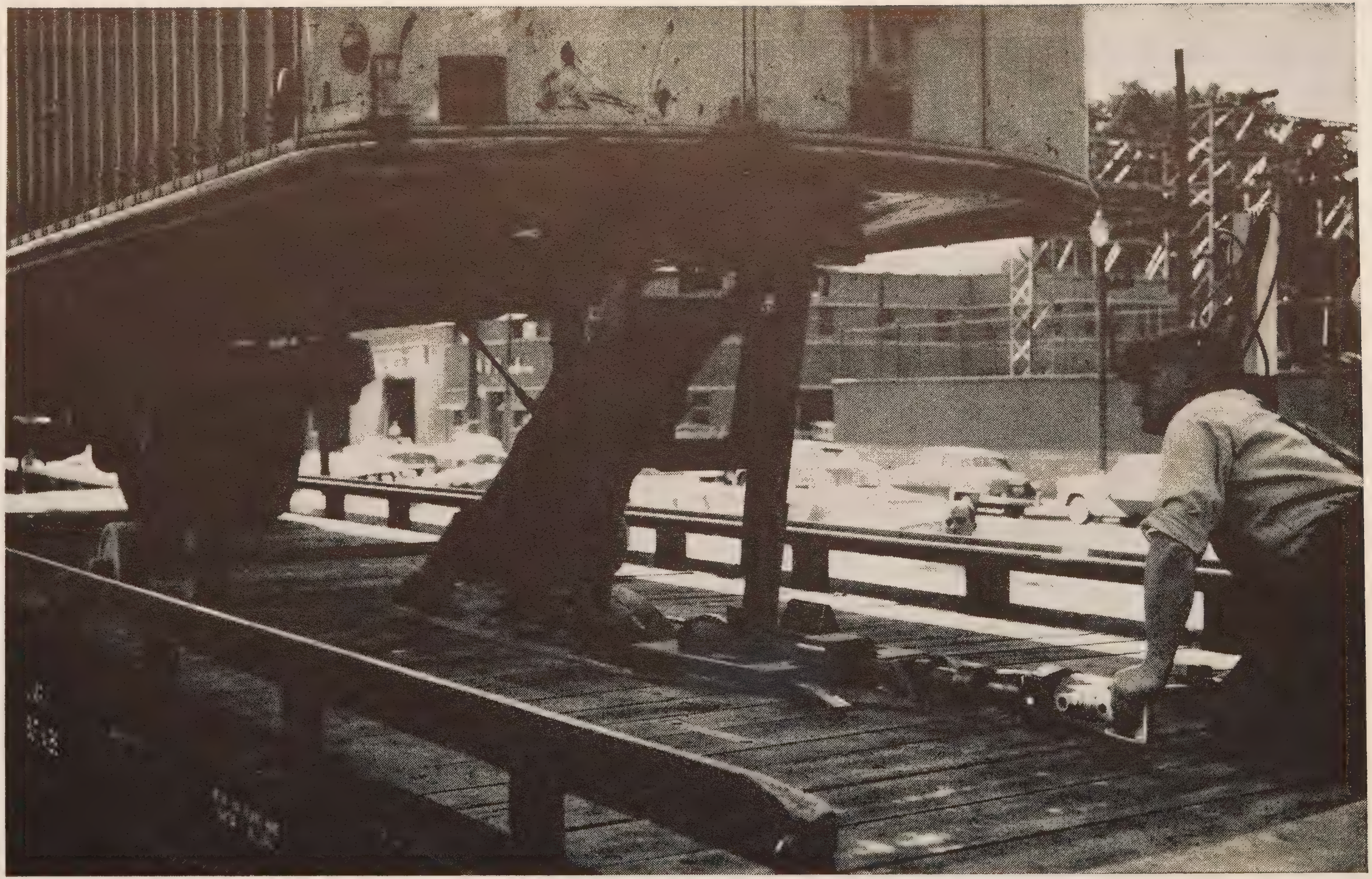

Figure 3

end as a bridge between cars.[1] The CNR had 120 of their ordinary flatcars adapted in this way for the use of highway common carriers by the end of 1957. The CPR had 200.

But standard flatcars were not built or equipped for the speed and continuous operation required by piggyback service.[2] Accordingly as new flatcars were built in Canada they were modified especially for piggyback. Such cars were equipped with steel wheels, roller bearings, steel deck, guard rails, retractable hitch and end-loading aprons. Axle-driven generators were added on some cars to serve refrigerated trailers. By the end of 1959, the CPR had 951 flatcars in piggyback service, of which 600 were these specially built piggyback cars. The CNR had 706 flats at the year-end with about the same proportion of new cars.[3]

Several features of these piggyback cars in Canada are noteworthy. Virtually all of them, both CNR and CPR, are equipped with the ACF retractable hitch for anchoring the trailers. This is significant. It means that piggyback service in Canada is primarily based on the use of ordinary highway trailers rather than special containers, as in the United States. In this, Canada's railways, in making piggyback services uniform and standardized throughout Canada, have apparently profited from the U.S. experience where a diversity of equipment has been a handicap in both costs and service.

Another difference is in the capacity of flatcars. Both CNR and CPR have adopted mainly the one-trailer flat, 46 feet in length, as the most suitable. (Figures 4 and 5.) This size enables them to carry any trailer, large or small, and to give each trailer individual service. Most of the U.S. railways have adopted the 85-foot, two-trailer flatcar. In Canada, such two-trailer flats were estimated to be less than 10 per cent of the total used for piggyback.

Piggyback development in Canada to date has placed little emphasis on special containers for TOFC use. Special containers, in this sense, are big boxes that can be readily shifted from one form of transport to another, i.e., chiefly between highway, rail or water services. Most of these containers are made from aluminum in various sizes from trailer dimensions down. Fork-lift trucks may be used to load and unload them. The difficulties in using only containers for piggyback is that containers, flatcars, loading facilities and highway vehicles would have to be standardized and uniform to enable the containers to be interchanged between railways and handled at any point of delivery. But the offsetting advantages of containers are also

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[1]On some of the first flats converted, the trailers were anchored with chains, jacks and chocks. The ACF retractable hitch, now being used, anchors the trailer kingpin at the appropriate height and thus eliminates the need for these other fastenings.

[2]The average number of miles travelled per day for a standard box car has been estimated as 35 to 40 miles against about 160 miles a day for piggyback flatcars.

[3]*Railway Age*, November 2, 1959, p. 36.

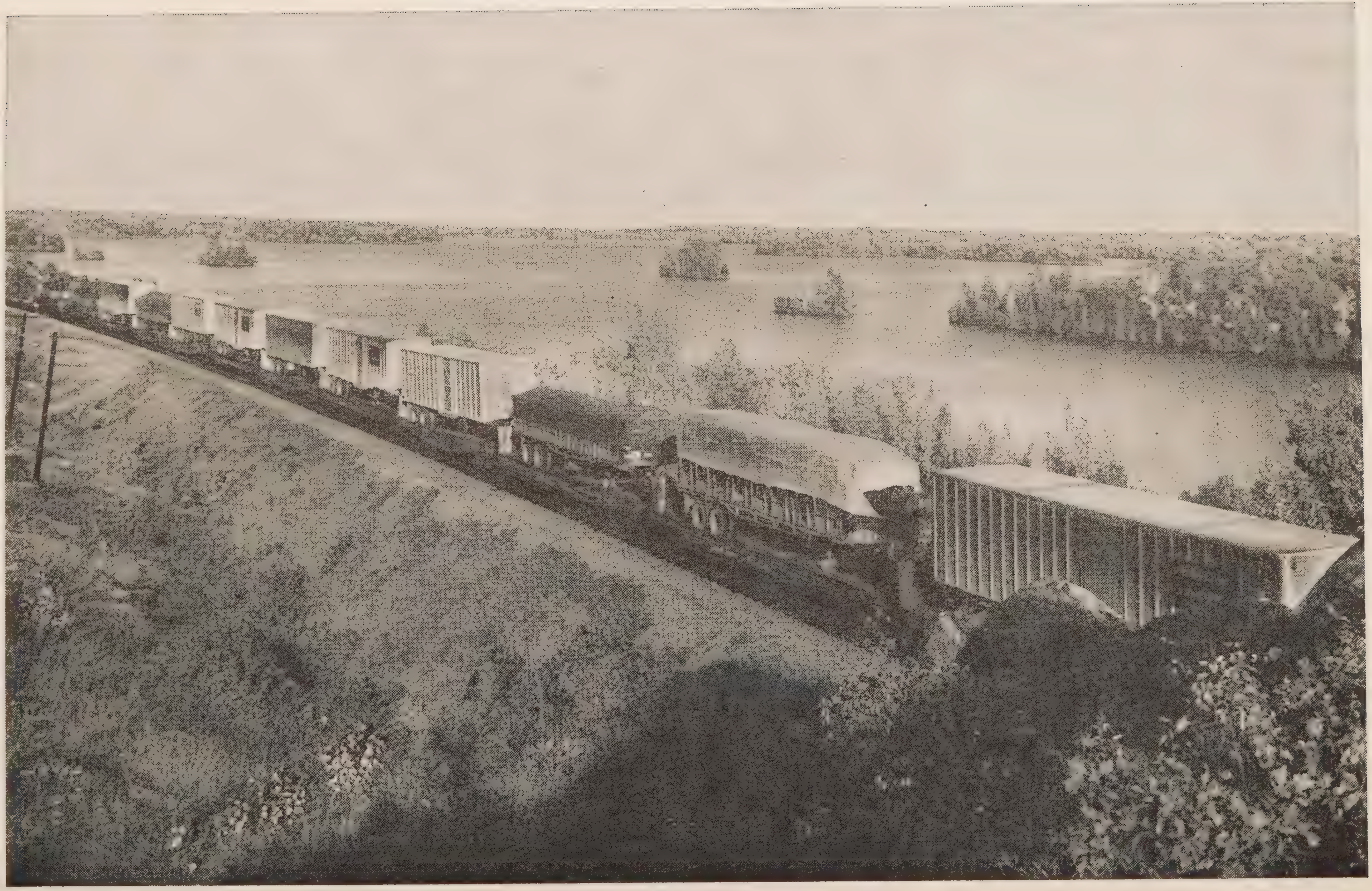

Figure 4

Figure 5

substantial—less tare may give more revenue per ton, less wind resistance in rail movements, and sometimes easier and faster loading and unloading, are some of these advantages.

Special containers are now being used to a limited extent in Canada[1] and their advantages are recognized by the railways.[2] But they were not looked upon as the ultimate objective in truck-rail transport such as the U.S. piggyback development might suggest. The CPR has emphasized that the use of highway trailers is not just an interim step toward complete container techniques but may well be a permanent method.[3] In other words, there are likely to be substantial advantages in continuing to concentrate chiefly on highway trailers for piggyback in the future. In the main, these advantages lie in their simplicity and flexibility for shifting from highway to rail transport and *vice versa* and the lower investment in providing a minimum of specialized equipment. To use specialized piggyback containers effectively would require a whole new line of equipment and facilities and a great deal more standardization of operations, containers, flatcars and loading methods. Lack of versatility of specialized containers would also mean many more empty returns than with highway trailers.

Efficient and economical containers and flatcars for this purpose have not been readily developed. Because of this, extensive specialized containerization for piggyback may not come soon in Canada. Because of their major emphasis on the use of highway trailers for piggyback, Canada's railways have been able to expand TOFC more rapidly and with a relatively smaller additional investment than has been the case in the United States. These considerations suggest that use of specialized containers for piggyback in Canada is likely to progress slowly and may never be comprehensive.

At the same time, where the traffic appears to warrant it, new trailers with more flexibility and capacity are being developed. A recent example was the CPR's new Car-A-Van.[4]

Rates

Since 1958, when publication of TOFC rates began in Canada, special rates have been established for various piggyback services including separate

[1] For example, the CNR has been using specially insulated refrigerated containers for the transport of fresh fish by piggyback from the Maritimes to Central Canada.

[2] Cf. A. E. Jenner, manager, CPR piggyback services, in *Canadian Transportation*, January, 1960, p. 31.

[3] *Ibid.*

[4] This is a new auto carrier built by the Strick Company of Philadelphia. Bought in late 1959 by Smith Transport for Western piggyback service, they are built chiefly of aluminum to carry cars westward and then, with ramps and partitions moved out of the way, to carry bulk cargo on the return journey. They hold promise of providing profitable services for all concerned. These auto trailers were brought out at the same time as the new 50.5-foot box car designed to carry 4 cars. Five hundred of these were ordered by the CPR.

rates for trailers owned by the railways, for-hire highway carriers, household goods carriers and subsidiaries of the railways.

Rates for trailers from for-hire highway carriers, Plan I, vary from 61 cents a cwt. between Montreal and Toronto to $8.85 from Montreal to Vancouver.[1] The tariff is assessed on the actual weight of the contents without the trailer but the minimum loaded weight assessed is 34,000 pounds. Empty trailer rates on the two above routes are 35 cents and $3.60 respectively, with a 20,000 pound minimum.[2] The railways do not provide protective services against heat or cold for the trailer cargoes and if refrigeration is provided by the shipper it must be of an approved type.

Piggyback services under this tariff (38D) are not open to all truckers. Only those for-hire truckers who have the necessary licences, from the provinces concerned, to serve the particular highway route between cities covered by the piggyback service, can qualify to use this rail service. In addition, a trucker must have made a prior contract with the railway company before he can ship trailers by rail. With a very few exceptions this tariff is "open", i.e., it covers any two points having piggyback service.

Rates for household goods in semi-trailers (also Plan I) are under a separate tariff (CFA Freight Tariff 37A). Charges in this case are, for example, 44 cents a cwt. from Montreal to Toronto and $3.85 from Montreal to Vancouver. The minimum weight is 20,000 pounds and empty trailers take the same rate as full. These rates, substantially below for-hire rates, are reported to be particularly attractive to movers. This tariff also is open, providing service between any two points having piggyback service.

The railways have established rates for hauling their own trailers (Plan II) including the service of picking up from the shipper and delivering to the consignee. CNR Tariff CM No. 195 is one of these. It is set up to provide graduated scales of rates (according to tonnage) between specific points. Because they are primarily competitive rates, these rates are quite selective and restricting in application.[3] For instance, rates are quoted between Windsor and Toronto and between Toronto and Halifax but there is no provision for a through rate between Windsor and Halifax. Another feature of this tariff is that the CNR's five ramp locations in the Maritimes serve as railheads for distribution of Plan II piggyback traffic via highway to numerous small points within a radius of 50 miles.[4] To illustrate the competitive nature of this CM No. 195 tariff, the rate from Montreal to Toronto including one pick-up and one delivery is 67 cents a cwt. (shipments 15,000 pounds or

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[1] Canadian Freight Association, Freight Tariff No. 38D. It became effective from January 4 and February 4, 1960.

[2] One trucking firm was reported to be knocking down his trailers for empty return, loading two or three knocked-down trailers on another one for return shipment by piggyback.

[3] Letter to the author, dated June 1, 1960, from Canadian National Railways, Ottawa representative.

[4] *Ibid.*

over). The rate for this route for for-hire trailers requiring no pick-up or delivery is 61 cents. Allowing for the cost of pick-up and delivery, the two rates are virtually identical.

The CPR, in the case of one of its subsidiaries (Canadian Pacific Transport) has established a tariff of agreed charges (CTC(AC)474) for shipping trailers on flatcars. This tariff requires at least 70 per cent of the annual aggregate ton-mile traffic be shipped via CPR. These rates are for trailers, empty or full, of a maximum of 35,000 pounds including the trailer. From Winnipeg to Edmonton the charge is, for example, $203. Four per cent is added for each 1,000 pounds over the 35,000 pound maximum.

Before appraising these TOFC tariffs, it should be emphasized that the service in Canada is still relatively new, is still being tested and some rates may, consequently, be tentative. Nevertheless, there have been no indications that the tariffs filed are temporary or subject to adjustment as traffic changes develop. Subject to these qualifications, it can be said that current piggyback service and rates show either definite or possible discrimination as between truckers, routes, ownership of trailers and commodities carried.

Regarding for-hire tariffs, it will be clear that in piggyback the railways are not providing a common (or public) carrier service. Piggyback service is provided only to those for-hire truckers who have signed contracts which have been accepted by the railways. If this contract requirement persists the railways can have a powerful voice in deciding which truckers are to enjoy any benefits of Plan I piggyback in the future. So far there has been no indication that any qualified trucking firms have been barred from service.

The limitation of Tariff 38D to truckers having provincial licences covering the comparable highway route must also be considered as discriminatory if piggyback is to be a common carrier service. But so long as the provincial governments have full responsibility for licensing and regulating both intra- and extra-provincial trucking, such a provision may be necessary to avoid conflicts.

Discrimination also appears to be evident among the rates established for the various routes. For example, the for-hire rate between Montreal and Toronto (61 cents a cwt.) is just under 3.6 cents per ton-mile (based on 34,000 pounds minimum weight). The rate between Montreal and Winnipeg ($4.46 a cwt.) is 6.6 cents a ton-mile. The rate for Montreal to Ottawa ($1.09) is over 18 cents a ton-mile. The Montreal-Ottawa rate may be expected to be above the Montreal-Toronto rate because it is a shorter haul and loading and unloading costs are relatively higher. But the Montreal-Winnipeg rate seems high relative to that for Montreal-Toronto since the

former is a much longer haul and loading costs are relatively less significant.[1] On the other hand, the volume of Montreal-Toronto TOFC traffic is much greater and this may reduce both loading and hauling costs by permitting more full trainload movements than on the Montreal-Winnipeg run.

But all of Tariff 38D rates are high relative to those in 37A (household goods). From Montreal the regular for-hire trailer rate to Toronto is 61 cents a cwt. against 44 cents for household goods; to Winnipeg, $4.46 against $1.89; and to Vancouver, $8.85 against $3.85. It is not surprising that household goods have shifted in large volume from the highway to piggyback.

Comparison of for-hire rates (38D) with agreed charge rates between Winnipeg and Edmonton shows the cost to for-hire truckers for a loaded trailer to be about $465 against $203 for the Canadian Pacific Transport under its agreed charge contract.

In summary, it seems apparent that considerable discrimination in rates and routes has been established; that relatively low rates have been established on routes where such low rates would attract a large volume of traffic (e.g., for-hire trailers between Montreal and Toronto, and household goods across Canada).[2] Evidence indicates that the railways have been successful in attracting traffic where the TOFC rates have been kept low.

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[1] This tariff (38D) is considered to be a competitive tariff so neither the "bridge" nor the special subsidy goes to reduce it. Trailer rates between Montreal and Halifax under this tariff are for railways only, so a similar comparison could not be made in that case.

[2] Other measures, in addition to low rates, are used to stimulate Plan I traffic. H. B. Parr, assistant freight traffic manager, CNR, states that "We've found that competition of reduced boxcar rates, coupled with Plan II piggyback, has given truckers extra incentive to use Plan I service". *Railway Age*, January 4, 1958, p. 16.

Contrasts in Canada—U.S. Development

Diversity in U.S. Techniques

In contrast with the uniform development of TOFC in Canada, United States piggyback has been remarkable for its great diversity of equipment and the large investments by various railroads in facilities that are specialized to the individual interests of particular railroads. A major obstacle to the growth of piggyback in that country now is the lack of standard equipment. Much of the equipment is so specialized that it prevents one railroad's use of another's facilities.[1]

This diversity starts with the approximately 9,000 flatcars used in piggyback in the United States. Only about half of them are equipped with the standard ACF hitch used in Canada. The rest require special hitches or rollers for loading (e.g., Clejan Car) or special trailer-containers. This means that piggyback services are not widely interchangeable among railways. Interline services are severely limited because connecting railways find it impractical to make the necessary transfers.

This diversity in flatcars in the United States has been paralleled by a diversity in trailer and container equipment. The New York Central, the Milwaukee Road and other railroads have invested heavily in Flexi-Van, a container that can be rolled by hand from its highway undercarriage onto the flatcar. The Chicago, Rock Island and Pacific has emphasized its Convert-A-Frate, involving various types of demountable bodies.[2] Pullman Trailmobile have a special flatcar and wheels-off van container called "PAT". Specially equipped trailers are required for use with the Clejan Car, a simplified but sturdy flatcar now in use and widely promoted in the United States. There are indications that the numbers of such specialized equipment will become greater in the United States as improved equipment comes on the market and each railroad vies to obtain the most efficient and profitable for its particular purposes.

This lack of standardization is an increasingly serious problem for piggyback in the United States according to the Interstate Commerce Commission.[3] Since it limits transfers of piggyback traffic from one railway to

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[1] Cf. *Piggyback and the Future of Railroad Transportation,* by John G. Shott, Washington, 1960, p. 33.

[2] *Ibid.,* p. 28.

[3] *U.S. News and World Report,* February 1, 1960, p. 100-102.

another it presents a serious obstacle to the future growth of TOFC.[1] It is because of this that so much attention has been given to containers and standardization in recent months in the United States.

A major development to meet this problem of diversity in equipment has been the organization of co-operatives for pooling piggyback cars. The largest of these is the Trailer Train Company of Haverford, Pa., which had a pool of over 3,000 TOFC flatcars available for interchangeable use by 18 railroads and one freight forwarder.[2] This technique has apparently given the participants many advantages over other railroads.

Differing Influences in Canada

Canada's railways have not been faced with this problem of diversity of piggyback equipment. As noted above, their policy has been to avoid it by emphasizing uniformity and interchangeability and concentrating on the use of standard highway trailers.

It has been possible to do this in Canada because of certain unique advantages enjoyed by the railways in this country. First, with only two major railways engaged in piggyback in Canada, against 50 in the United States, co-operation in developing uniform and interchangeable piggyback techniques has been easier.[3] Second, with relatively fewer transcontinental and other truck highways in Canada more of the long-haul traffic has had to go by rail. Piggyback can thus compete more effectively with trucks for this traffic than it can in the United States. As a result more deliberate consideration could thus be given to developing techniques in Canada. Third, there has been much closer co-operation between the railways and independent truckers in Canada. This has provided Canada's railways with a supply of highway trailers for piggyback that has not been available in the United States. And finally, with both major railways providing a transcontinental service, long-haul piggyback could be established with fewer interchanges of equipment

[1] An official of Montgomery-Ward states that "the heterogeneousness of (U.S.) piggyback equipment prevents shippers like us from making through-movements over multiple lines". See *Dun's Review and Modern Industry*, June, 1959, p. 82.

[2] *U.S. News and World Report*, February 1, 1960, p. 100-102. A co-operative shipping association in California provides trailers and flatcars and has estimated savings of 15 to 35 per cent under regular freight charges. See *Railway Age*, February 23, 1959, p. 9.

[3] A start was made in 1960 on a co-operative attack on this problem in the United States with the appointment by the American Association of Railroads of a special task force to develop a uniform code of interchange rules for piggyback service. Another group is working on standardizing TOFC charges. Yet these will not reach far into the major problem, i.e., *equipment uniformity.*

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between railways than was possible in the United States. These continuous hauls save time, eliminate much of the interchange problem and reduce frictions between competing companies.

Because of these differences in the environment of development it is to be expected that piggyback should take a somewhat different course in Canada even though Canadian development followed, in time, the development across the border. These differences are found in many fields: containers, forwarders, equipment leasing, mergers, use of plans, rail-truck co-operation, rates and labour.

Containers

In Canada, containers have not been given the important role in piggyback that has been accorded them in the United States.[1] This greater emphasis in the United States on containers for piggyback may be attributed in part to the greater diversity of U.S. equipment which has encouraged the promotion of uniform containers as a means of standardizing equipment. Containerization is expected to break through this barrier of multiplicity of equipment and permit United States shippers to obtain through rates over multiple lines. But containers, to be sufficiently versatile for this purpose, would require construction of special boxes in addition to the trailer needed to transport them to the rail terminals. These special boxes mean not only extra investment costs but also extra handling costs at the terminal relative to highway trailers.[2]

These extra costs might well be recouped in the United States if such containers overcome the interchangeability problem. In Canada, where TOFC equipment is already interchangeable, these special uniform containers are likely to continue to play a much smaller role. Containers in Canada appear likely to be confined to a few specialized uses. Piggyback has been termed the "first big application of containerization"[3] in the United States but in Canada, where piggyback service depends mainly on highway trailers, and these trailers provide the uniformity required for interchangeability, containerization is unlikely to move much beyond this except for special uses—such as overseas shipments.

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[1] Professor Geo. F. Baker of Harvard University states, "If containers enable interchange this will permit any shipment anywhere on a single bill of lading, using any and every mode of transportation to its best advantage", *Dun's Review and Modern Industry*, June, 1959, p. 88. In Canada, where carriers are fewer and provide coast-to-coast service, shippers have in the main always enjoyed this kind of service.

[2] Terminal facilities for side-loading flatcars with containers are more costly than end-loading trailer ramps.

[3] *Fleet Owner*, July, 1959, p. 64. Many reasons are given in support of containers-on-flatcars in place of the present trailers-on-flatcars in the U.S. but a "greatly expanded interchange" between highway and rail service is predominantly emphasized. But another researcher states, "It is probably too early to speculate that containers will displace the conventional semi-trailer now used predominantly in piggyback operations". See *Piggyback and the Future of Railroad Transportation*, Washington, 1960, p. 27-28.

Forwarding

A second difference between Canadian and United States development is in freight forwarding. Freight forwarders are agents who organize the transportation from shipper to consignee, negotiating with the various carriers concerned for the most suitable service and rates. In the United States the lack of co-operation or standardization among railroads and between railroads, truckers, water carriers, etc., has led to a fairly extensive growth of freight forwarding services. Piggyback, with its requirements for interchangeability, has undoubtedly contributed to the growth of this service. Eventually, piggybacking may bring into being companies which will do an over-all transportation job, utilizing all types of carriers and equipment to fulfil the needs of their customers, according to Mr. H. W. Von Miller, head of the Erie Railroad.[1]

There is little evidence of such a need in Canada. Railways and trucking companies are better co-ordinated to provide a complete shipper-to-consignee service than in the United States. In consequence, piggyback in Canada has not been accompanied by a parallel growth in freight forwarding.

Leasing

A third difference is in the leasing of piggyback equipment. In Canada, very little equipment is leased. The railways own the flatcars used and they and the truckers own the trailers they carry on piggyback. In the United States, leasing of flatcars and trailers[2] has begun to play a major role in piggyback services, no doubt as a means of standardization. Several companies lease equipment to private shippers and to railroads.[3] Some of these are freight forwarders.[4] Closely related to this direct leasing are the pooling operations of Trailer Train Company, noted above. Thus leasing and pooling of equipment is being used in the United States to overcome the tendency toward diversity and to promote a degree of standardization. Such special measures have not been required in Canada.

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[1] *Barron's*, August 4, 1958, p. 17. An example of this trend may be the United States Freight Company which is reported doing a $175 million business in freight forwarding. Morris Forgash, president, predicts that most railroad cars will be supplanted by trailers on flats within 10 years. See *Dun's Review and Modern Industry*, June, 1959, p. 63.

[2] Reading Railroad leases 80 per cent of its 250 highway vehicles. *Railway Age*, February 22, 1960.

[3] GATX, the third largest railroad car manufacturer, has a fleet of 65,000 cars (this includes box as well as piggyback cars) and handles 50 per cent of United States leased freight rolling stock. *Business Week*, November 8, 1958, p. 54-56.

[4] U.S. Freight and Republic Carloading are freight forwarders who lease flatcars for use in Plan III piggyback.

Mergers

A fourth difference is seen in the increasing recognition in the United States by railroads and by the ICC and others, of the need for and the advantages of mergers of railroads. Piggyback has been a major factor in demonstrating the advantages of joining railroads together to provide fast, through point-to-point service. The setbacks to promising piggyback imposed by the difficulties of transferring from one carrier to another, often several times, have demonstrated possibilities for reducing costs and improving service by combining the operations of the railroads concerned.

Plans

The differing environment of development has had a significant influence on the kinds of plans used in the two countries. In Canada, piggyback has been confined to Plan I (railways carrying for-hire trailers) and Plan II (carrying railway-owned trailers).

In Canada, three-quarters of the TOFC traffic is under Plan I. In the United States, major support has been given by the railroads to Plan II and Plan III (carrying trailers owned or leased by shippers) while Plan I traffic has not been widely encouraged. Of the 50 out of 114 Class I railroads in the United States providing some piggyback service in 1959, only 22 gave Plan I service while at least 44 gave Plan II service. At least 23 United States railroads provided Plan III service. Plan IV (shipper furnishes trailer-loaded flatcar) was offered by 18 railroads.[1] Several United States railroads use Plan V involving joint rates and services with trucking firms.[2] Some have used Plan VI, providing L.C.L. service.

This extensive use of diverse arrangements for piggyback transport in the United States appears to be due to efforts of individual railways to exploit as fully as possible every traffic potential within its own reach. These efforts have apparently operated against the promotion of interline traffic and standardization of equipment or services. The increasing growth of Plans III and IV in recent years indicates an increasing dependence by United States railroads on flatcars and trailers provided by shippers, forwarders or equipment leasing companies. The rapid growth of freight forwarding and equipment leasing indicates that the railroads may be losing control of the co-ordination of piggyback. There is evidence that this development may be the first major step toward an extensive merging of United

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[1] *Dun's Review and Modern Industry,* June, 1959, p. 64.

[2] Rock Island Railroad and Consolidated Freightways publish joint rates in 12 states for truck-rail service.

States railroads' operations that will enable them to provide a more standardized service and avoid the costly and difficult transfers now required in through service and which are such a handicap to improvement.

In contrast the railways in Canada have had little difficulty in providing effective co-ordination of through piggyback service coast-to-coast. In addition, by confining their service to Plans I and II, with some Plan III possible in the future, they have kept the control of both the equipment and the services in their own hands. Under Plan I, Canada's railways have developed a large and profitable traffic while providing a useful service to for-hire truckers. United States railroads have been able to exploit this profitable Plan I traffic only to a limited degree.

Rail–Truck Combination

Another condition which may be preventing United States railroads from utilizing piggyback potential to the fullest possible extent is the result of the decisions by the United States courts prohibiting the purchase or development of trucking lines by railroads unless such lines are used only to supplement their rail service.[1] In contrast Canadian railways have expanded extensively in the ownership of truck lines.

This means that United States railroads may be handicapped in developing traffic for both Plans I and II relative to Canadian railways. In Canada, piggyback and trucking have tended to complement each other whether the trucks are rail-owned or independently-owned. Canadian railways are also permitted to own trucking subsidiaries which may operate as independent common carriers as far as piggyback is concerned.

In the United States piggyback is facing increasing competition from independent highway trucking services. Because the United States railroads have not solved the problems of interchanging and interlining, they have not been able to use fully their strongest competitive weapon, i.e., low line-haul costs on long through hauls. Their competitive advantage is thereby reduced. This strikes piggyback service particularly hard. It is undoubtedly a major factor in its slower growth in the United States than in Canada.

Rates

This United States competition is probably most clearly evident in the contests before the Interstate Commerce Commission over rates. Applications

[1] A recent U.S. Supreme Court decision, for example, rejected an ICC order authorizing Pacific Motor Trucking Company, a subsidiary of Southern Pacific Railroad, to haul automobiles as a contract carrier for General Motors Corporation, stating that only common carrier service supplementary to railroad service could be performed by such a trucking subsidiary.

of the railroads to lower their Plan III and IV rates are opposed successfully by trucking companies who argue that it would constitute unfair competition. This has been reported as a major handicap in the growth of piggyback in the United States. Railways have also complained that Plan II tariffs are too high, being identical with those used by common carrier truckers.[1]

The ICC has jurisdiction over both rail and truck rates and in the past it has appeared to agree with the truckers' contention that lower piggyback rates would constitute unfair and destructive competition to the truckers.[2] But the 1958 amendments to the ICC Act appear to have led to some modification of this position, to the extent that freight forwarders have been allowed to reduce certain rates. In September, 1959, the ICC approved a schedule of lower rates published by freight forwarders but it had earlier suspended a schedule of reduced piggyback rates, published by the railroads, which constituted the foundation for the lower forwarder rates. Truckers had protested against both rate reductions but only the rail schedule was suspended.[3]

Perhaps it is because of these rate conflicts with the truckers that the railroads in the United States view Plan I piggyback as being somewhat adverse to their interests and see most of the potential in piggybacking trailers for forwarders and others under Plans III and IV with some lesser opportunities in Plan II.

In Canada, rates for Plans III and IV have not yet been established but, for the purpose of making a comparison with United States rates, Canadian for-hire rates (Plan I) may be used. The services provided by Plan I in Canada are the same as for Plans III and IV in the United States, that is, point-to-point carriage with no pick-up or delivery.

United States rates (Plans III and IV) are usually based on a flat charge, ordinarily on a trailer-mile or car-mile basis. The United States Plan III (shipper provides trailers) charge is ordinarily 25 cents a trailer-mile for a two-trailer flatcar, or 50 cents a car-mile. Plan IV rate, with shipper providing both trailer and flat, is 40 cents a car-mile.[4]

Comparison of these rates with the for-hire rate between Montreal and Toronto (61 cents a cwt.), which may be considered in Canada as being reasonably low[5] (and is low relative to most other Canadian rates), indicates that, if the United States rates are high (as U.S. railroads claim),

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[1] *Business Week,* February 16, 1957, p. 114-116.

[2] *Piggyback and the Future of Railroad Transportation,* by John G. Shott, Washington, 1960, p. 13 and following.

[3] *Ibid.* A Plan III proposal of the Burlington Railroad has been condemned by the ICC for its "unduly low" rates and constituting a "destructive competitive practice". *Railway Age,* March 16, 1959, p. 28.

[4] *Dun's Review and Modern Industry,* June, 1959, p. 74, and *Railway Age,* November 30, 1959, p. 55.

[5] J. R. MacLeod interview.

then Canadian rates must be quite high also. The Montreal-Toronto rate based on a minimum trailerload ($7\frac{1}{2}$ tons) would be about 27 cents a trailer-mile. On a 10-ton load it would be 36 cents a trailer-mile. Against the United States rate of 25 cents, which is claimed by the railroads there to be higher than costs warrant,[1] Canadian rates would appear relatively high.

This may indicate that TOFC operating costs are higher in Canada than in the United States or that a wider margin of profit is being taken in Canada. In either case, it suggests that trucking services by highway can compete in rates more easily in Canada than in the United States.

Labour

A preliminary comparison of union arrangements with respect to piggyback indicates that for-hire truckers in Canada may have some advantages relative to those in the United States in making use of piggyback services. United States labour contracts were reported to require that all union drivers in the employ of the company must be engaged before piggyback services could be utilized.

In Canada, a recent Ontario arbitration board decision indicated that the drivers' union contract placed no limitation on the use of piggyback. On the whole, however, there appears to be little opposition to piggyback from labour unions. This may be because, with the continued growth of trucking, driver employment has been holding steady or expanding.

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[1] In support of their action to have such rates reduced "the railroads have submitted extensive cost studies and analyses and other supporting data". *Piggyback and the Future of Railroad Transportation,* by John G. Shott, Washington, 1960, p. 15.

Competition with Conventional Rail Operations

General Services

The major advantages in services provided by piggyback relative to conventional railway freight services are in reducing handling operations, increasing speed of delivery, providing certain specialized services and reducing losses and damage. Trailers can be loaded at the factory, sealed and taken directly to the piggyback terminal where within an hour or two[1] they may be loaded on flats, switched into trainloads and under way on the main line. This does not get trailers started on the way quite as fast as direct highway transport would, but it can be a very great improvement over standard box car services.

TOFC service reduces handling and time of delivery by circumventing freight sheds, team tracks and sidings. Team track operations usually require two additional handlings, one each at origin and destination, that direct piggyback service can avoid. In the case of operations through freight sheds with less-than-carload shipments large enough for a full piggyback trailer-load, four such handlings can be eliminated.[2] Labour is the most important factor in these handlings of freight and at current wage levels the savings by piggyback can be very great. Of course, some less-than-trailerload shipments must still be handled through freight terminals whether they go by piggyback or box car. But TOFC loads being smaller, much more of the freight can be handled directly by piggyback. The CPR has reported a sharp increase, beginning in 1959, in the numbers of its cartage and express trailers being shipped by piggyback.[3]

TOFC service can also speed delivery by eliminating most of the yard classifications including those at origin and destination. Delivery time is also reduced by eliminating much of the switching, including dropping off cars at intervening points. The total time saved by piggyback relative to box car service is commonly very great in these operations. Classification can usually be carried out while the trailers are being loaded at the ramp and point-to-point shipment of trailers makes classification en route or at destination unnecessary. Switching en route, when necessary, can be simplified by

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[1] About three to six minutes to load or unload each trailer is reported to be required. About 30 minutes is estimated to be the time required to make up a 60-car train of trailers. The rest of the time would be required to move the trailer train from the ramps to the main line. The time for this depends on location of the terminal and other conditions.

[2] Cf. *Economics of Competition in the Transportation Industries*, by John R. Meyer, *et al.*, Cambridge, 1959, p. 103-104. This reference will be called Meyer, *et al.*, henceforth.

[3] A. E. Jenner, in *Canadian Transportation*, August, 1959, p. 34. These may be increased still further as the co-ordination of L.C.L. express and railway truck traffic, now being organized in Vancouver and Vancouver Island, is extended. See N. R. Crump in *Western Business and Industry*, August, 1959, p. 33.

having special road-switcher locomotives drop the cars at trailer ramps located outside major cities. But highway truck hauls may be more desirable than such switching operations except where the volume is large.

For convention box car movements classifying, switching and line haul consume the most time, aside from the extra time taken for loading and unloading at origin and destination. A United States study[1] estimates that 10 per cent of the line-haul time (this would be roughly about 2.3 hours for the average rail haul of 431 miles[2] in Canada) is spent on sidings en route. An average of eight hours is required for switching at terminals, the average distance between terminals being 140 miles. In Canada, with an average freight haul of 431 miles by rail, such switching would average over 24 hours per haul. In addition, the United States study estimated an average of 48 hours was lost in movements of rail freight at origin and destination.[3]

On this basis, something over 74 hours, aside from running time, would be taken on the average to deliver freight in Canada by the standard box car method.[4] United States railways would be higher than this, since extra time for interchanges is not included in the 74 hours.

By piggyback, much of this average loss of 74 or more hours can be eliminated and, in addition, the line-haul time is usually reduced by using faster trains than the standard freights.[5] Because of these time reductions, piggyback has been able to give a very great improvement in speed of delivery over conventional rail service. It can approach close to truck services in this speed of delivery except for the short hauls.

Piggyback can also give overnight service, like trucks, on traffic that box car services would require three or four days to deliver under normal conditions. Overnight TOFC service is important if railways are to compete with trucks.[6] But suitable schedules for such overnight service must also be

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[1] Meyer, *et al.*, p. 192-193. Some of the findings of this study were based on the experience of the CPR but most of the data were from U.S. railroads.

[2] Average haul per ton, 1958 *Waybill Analysis.*

[3] This U.S. study also allowed extra time for interchanges, but these would be fewer in Canada, with only two railways.

[4] Another U.S. transportation specialist estimates 6 to 48 hours as the time required to switch a carload of freight through the classification yard, etc., before getting it under way on the main line. Additional stops are made along the main line to drop off and pick up cars. Then at destination the box car traffic must pass through a second classification before reaching a point where it may be delivered. Freight is sometimes in Chicago 48 hours before the consignee receives it. Thus, while the average U.S. freight haul is 429 miles, because of classification and switching, the average freight car goes only 48 miles in the average day. See *The Second Transport Revolution*, by Marvin J. Barloon, Harper's Magazine, March, 1957, p. 39.

[5] An average road speed for standard U.S. trains of 18.7 miles an hour was used in the U.S. study. Average speeds of piggyback trains in Canada were not available but they would probably be close to double that figure.

[6] President Jack Snead of Consolidated Freightways (reported to be the largest U.S. trucking firm) states that customer service demands overnight service for 92 per cent of the shipments out to 450 to 500 miles. See *Railway Age*, February 29, 1960, p. 15.

established to meet customer requirements in this respect, i.e., delivery of trailers to the ramp up to late in the evening, the piggyback train leaving about 11 p.m. and arriving at its destination by about five to seven a.m.

This is the type of TOFC service provided between Montreal and Toronto (340 miles) and which has proven so popular with for-hire truckers. By August, 1959, the CPR was running two solid piggyback trains each way on four nights a week on this route and one each way on Friday and Saturday nights.[1] Similarly, a solid CPR piggyback train was going each way on five nights a week between Montreal and Ottawa and also between Montreal and Quebec.

Speed of piggyback service has been improved further by using fast freight locomotives or by including TOFC in passenger train consists. In fact, piggyback is said to have saved some passenger runs in Canada by providing the extra revenue needed to make them profitable.[2]

A major service advantage of piggyback over conventional box car operations in Canada is the flexibility and adaptability that has been developed from the beginning in TOFC. Special refrigerated trailers have been equipped for the service with battery-operated cooling. Some flatcars are provided with generators for recharging these batteries.[3] Special coast-to-coast services were provided at special rates for household goods shipped in trailers, starting in February, 1959.[4] This was a service that furniture movers had been seeking for many years. It is being widely used already. The CNR has, since July, 1959, provided a piggyback service for complete tractor and semi-trailer units as well as for smaller trucks (which are tied down to the flatcars) between Moncton and Halifax. Other special piggyback services have been adapted to the needs of truckers and other shippers. But in the main, TOFC should be considered as a general rather than a specialized service, considering the nature of its traffic.

Perhaps the most widely recognized service provided by piggyback is in the great reduction of losses and damage relative to conventional freight shed and team track services. Trailers can be sealed when they leave the shipper's warehouse and need not be opened until they reach the consignee. The result: a very large decrease in pilferage losses. With the number of handlings reduced and shipments riding more smoothly in the trailer on the flatcar than in the standard box car (and possibly more smoothly than on the highway), the chances for breakage or other damage are also greatly reduced.

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[1] *Canadian Transportation,* August, 1959, p. 34.

[2] *Railway Age,* May 16, 1960, p. 9. The extra cost of handling TOFC on passenger runs may be substantial, however.

[3] In the main, TOFC serves non-perishable traffic, however.

[4] See report by Donald Gordon in *Monetary Times,* Annual National Review, 1960, p. 98-102.

Services to Truckers

Piggyback provides special services to certain users. For-hire truckers are given much greater flexibility in their peak load operations by TOFC service. Trailers may be loaded beyond the number of tractors or drivers available and the surplus shipped by piggyback. The importance of this facility to the larger truckers has been widely recognized. In addition, on heavily travelled highways between major industrial centres, such as between Montreal and Toronto, piggyback may provide these common carrier truckers with a faster and more economical service than their own tractors and drivers could provide. Where piggyback can schedule an overnight service it may assist trucking firms a good deal. Piggyback may provide an economical alternative in winter if snow or ice makes highway travel difficult from time to time. This is not the serious hazard it used to be, however.

Piggyback, by reducing the number of vehicles on the highways, may tend also to ease the problem of adverse public relations for trucking companies. It may be possible also that interprovincial piggyback services may be used to a greater extent in future to avoid limitations on load weights, trailer sizes, and such, which are imposed seasonally or otherwise by the various provinces.[1]

Services to Shippers

By careful study and planning and the adaptation of truckers' techniques to TOFC service, Canada's two major railways have undoubtedly tried to provide, in piggyback operations, a service that meets the speed and service needs of shippers. In the main they have been successful. Shippers accustomed to using conventional box car services find it most satisfactory in terms of faster delivery, goods received in better condition, fewer claims and losses and savings in costs and inventory. Some shippers, accustomed to truck service say that piggyback has made CN and CP rail services competitive again in service and rates with highway transport.[2] While the trends in the distribution of freight traffic do not quite support this latter opinion, nevertheless piggyback has brought a vast improvement in a major area of rail freight service and in several features has advantages over highway transport.

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[1] It should be noted that piggyback is not likely to be used to circumvent the lack of reciprocity in licensing, however. Under present contract conditions, for-hire truckers using piggyback must have the necessary licences for the route before they are allowed to use piggyback. Piggyback in Canada may differ in this respect from the U.S. In that country, truckers are reported being drawn to piggyback by increasing ton-mile tax rates, increasing licence fees, higher fuel costs and load limits and other revenue fees that make highway transport difficult. See *Business Week*, February 16, 1957, p. 114-116. On the other hand, the limited use of piggyback by for-hire truckers in the U.S. relative to Canada does not support this statement.

[2] *Canadian Transportation*, August, 1959, p. 39.

Services to Railways

Before leaving the subject of services, a brief account of the services and benefits of TOFC to the railways themselves should be given. Probably the best summary of favourable views on these is found in the report of a round-table discussion organized by *Railway Age* and reported in the January 13, 1958, issue of that magazine. Traffic experts from United States and Canadian railways concluded that piggyback service:

1. Provides a way to go after high-rated traffic now moving over highways.
2. Permits high utilization of equipment.
3. Produces revenues per unit exceeding those of carload freight.
4. Reduces damage claims.
5. Puts a growth element in the traffic pattern.
6. Offers an effective means to compete for short-haul traffic.
7. Establishes highly dependable service, where shippers can obtain deliveries timed to their specific needs.
8. Sets the stage for recapture of L.C.L. businesses and make it profitable without big capital expenditures.

In brief, these say that piggyback allows the railways to circumvent many of the most costly and time-consuming operations of conventional rail freight services in order to compete in costs, speed and service with trucks. As expressed, these opinions appear somewhat more optimistic than this but they indicate also the enthusiasm of many railway traffic men for the new opportunities offered in piggyback. This enthusiasm has arisen because piggyback is the first major improvement in rail freight service that shows positive evidence of enabling the railways to compete for the most profitable traffic with trucks.[1]

At the same time, piggyback enables the railways to serve more conveniently those shippers whose plants are not located on rail sidings. It permits piggyback cars to be used much more fully than box cars in conventional service. One estimate puts TOFC utilization at four times that of freight cars

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[1] With the exception of piggyback, virtually all the railway improvements in recent years have been cost-reducing improvements. See, for example, N. R. Crump in *Western Business and Industry*, August, 1959, p. 33, where he stresses that the cost of dieselization, $200 million to the end of 1958, saved $40 million in transportation expense and $9 million in maintenance expense each year for the CPR. But while the railways have been making these cost improvements, shippers have tended to seek the extra services and speedier deliveries, at higher costs, as supplied by the truckers. Piggyback comes close to meeting the service competition of trucks within the field in which it operates. Cf. M. J. Barloon, *Harper's Magazine*, March, 1957, p. 39.

as a whole—an average of 175 miles a day for piggyback versus 47 miles for all freight cars.[1] Trailer Train Company in the United States, the largest TOFC agency in the United States, reports a flatcar utilization of 197.2 miles a day on 85-foot piggyback cars against 29.3 miles for all other cars.[2]

The lower cost for equipment and facilities required for piggyback relative to conventional service is another feature attractive to the railways. Investment and maintenance costs appear likely to be so small in comparison with those for customary freight terminals, team tracks, sidings, classification yards, etc., that the railways will have an immediate and strong incentive to divert as much box car traffic as possible to piggyback.

The costs of handling freight in TOFC service are reported to be remarkably low in comparison with conventional freight services,[3] though such costs may not always be accurately reflected in piggyback rates. A Pennsylvania Railroad official states that it costs his company only $19.37 to get a loaded Plan III piggyback car into its train and ready to roll at the New Jersey terminal. But it costs $180 to get the same amount of revenue freight loaded into box cars in Manhattan and have them switched and reswitched into a road train in New Jersey. He also reported a forwarder shipment of 46.2 tons moving in box cars from New York to Chicago, which yielded a total revenue of $1,523.79, less terminal expenses of $510.18, left only $144.80 per car for line haul and Chicago terminal expenses. By Plan III, piggyback on the same route, 32 tons produced a total revenue of $451.50, less $37.56 for terminal expenses at both ends, leaving a balance clear for line haul of $413.94.

These low terminal costs for piggyback have allowed Canada's railways to set moderate (e.g., Montreal to Toronto) to high rates for the service and still obtain generally higher earnings than can be gained from carload freight. The CPR reported an increase in gross revenue of $4.5 million in 1958 from its common carrier piggyback (Plan I) services alone.[4]

If United States experience is an indication, the result has been that piggyback traffic has made very desirable increases in net revenues for both major Canadian railways.

United States rates though on a mileage rather than a weight basis as in Canada, were fairly close in the comparison made above to rates in Canada and the United States railroads report remarkable gains in net revenue

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[1] *Canadian Transportation*, August, 1959, p. 40. This estimate, made by American Car and Foundry Company, probably included U. S. railroads, for whom ACF also makes hitches, in addition to the CNR and CPR.

[2] *Piggyback and the Future of Railroad Transportation*, p. 41. Trailer Train recently reported its average piggyback car goes 11,442 miles in 60 days. Its record for a single car was 17,296 miles in 30 days.

[3] *Piggyback and the Future of Railroad Transportation*, Appendix III, p. 39. There is little public information available in Canada on piggyback costs and revenues.

[4] *Seventy-eighth Annual Report*, 1958, p. 43.

from piggyback. For Plan III (shipper-owned trailers) between Chicago and points on the East Coast, the rates are 50 cents per car-mile and the revenue over out-of-pocket costs were reported to range from $108.25 to $198.79 per car.[1] Between Chicago and St. Louis this revenue margin ranged from $132.94 to $239.08 a car. Under Plan IV, piggyback cars between Chicago and the southwestern states gave returns over out-of-pocket costs of $311.40 to $379.19.[2] One United States railroad reported that on the average it makes, after expenses, about $110 per trailer under Plan I, $55 under Plan II and $150 under Plan IV. Missouri Pacific Railroad reported its average revenue in 1958 for each container or trailerload was over $180 against an average revenue for non-piggyback cars of about $146.[3]

Limitations of Piggyback Services

Yet it may not be assumed from the above analysis that the improved revenue and service features of piggyback will allow it to expand indefinitely at the expense of box car traffic.

Piggyback is clearly limited in how far it can supplant box car services. On the one hand, it is limited to the traffic areas where it has an advantage in efficiency over box car services. On the other hand, it is limited by the efficiency of highway trucking services.

Looking first at current box car traffic, piggyback at present has potential advantages in only a part of it. This area of potential TOFC advantage includes small shipments under 15-20,000 pounds (i.e., much of the railway express and L.C.L. freight) and other shipments that are high in value and require considerable manual handling (such as the manufactured and miscellaneous freight classification). TOFC service can reduce the number and costs of handling of such traffic. It can give speedier delivery and other added services. But such traffic comprises only about 25 to 30 per cent of total box car traffic.

Most of the railways' current traffic, 65 to 75 per cent, is in bulk, machine-loaded products that will continue for some time to be most efficiently handled by box or gondola car services as at present. This freight traffic which can be handled in large volume by machine loading includes iron ore and other minerals, some timber products, grains, certain chemicals and

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[1] *Railway Age*, November 30, 1959, p. 55 et seq. In these examples, out-of-pocket costs include a 4 per cent return on 50 per cent of the road costs and on 100 per cent of equipment costs.

[2] *Ibid.* The Pennsylvania Railroad reported that Plan III earnings were about 50 per cent above Plan I and substantially above Plan II earnings.

[3] *Railway Age*, February 16, 1959, p. 60.

others. In the case of these commodities, machine handling in trainload volumes by box or gondola car provides lower cost service than piggyback would now be able to give.[1]

This means that piggyback is likely to compete for about 25 per cent or less of the railways' current freight traffic.[2] In 1960, TOFC had assumed 4.3 per cent of total railway carloadings. It should reach considerably further into the 25 per cent than this and should thereby enable the railways' to retain more of its profitable traffic. But it may be reasonable to expect that piggyback will not reach much beyond 10 per cent of total carloadings, the rest being held by box car services or lost to trucking.

Piggyback is limited also in the range of its competition with trucking. Piggyback is excluded from competition with highway services on most short hauls because of the extra costs and time lost in loading and unloading at piggyback terminals.[3] Mr. A. E. Jenner, manager of CPR piggyback services, has stated that the trucking industry is more effective for hauls under 250 miles, trains for mass movements on long trips.[4]

Because TOFC must give trainload, terminal-to-terminal service to compete effectively in speed and service with trucking, it is, in effect, excluded from the traffic of intervening stations. Piggyback is also at a disadvantage at terminals where the volume of traffic does not permit trainload movements. Most TOFC shippers want overnight service and this is not readily operated on a profitable basis unless trainload volumes are available. The volume must also be sufficient to warrant the cost of installing the terminal facilities. Empty returns are costly, so there must be a reasonable balance of traffic both ways on each route. Nor can piggyback be allowed to downgrade the speed and service of passenger and mail trains. All of these limit the scope and flexibility of TOFC in its competition for traffic with direct trucking.

At the same time the growth of TOFC should support some expansion of trucking, not only to serve intervening stations but in other areas. Because the piggyback role is mainly in providing full-train service between major

[1] In the main, these are low-rated, low-profit traffic. The tendency for the railways to retain only this traffic is somewhat further advanced in the U.S. As early as 1957, A. E. Perlman, then president of the New York Central Railroad stated that soon only these low-rated commodities would be left for box cars. See *Business Week*, February 16, 1957, p. 114. Compare also Meyer, *et al.*, "Intercarrier competition for the carriage of high-value goods (mostly manufactures and miscellaneous) exists among rail boxcar, piggyback, package freighter and truck transportation and for bulk goods (mostly products of forests, mines and agriculture) among water, pipeline and rail transportation", p. 188.

[2] This 25 per cent, mostly manufactures and miscellaneous, is normally higher rated and should be more profitable for piggyback than other box car traffic.

[3] It has been estimated that it would cost a trucker, on the average, as much to move a trailer (whether rail- or independently-owned) from where it is loaded to the TOFC ramp and from the ramp at destination to the consignee as it would cost to deliver it direct by highway 100 miles.

[4] *Canadian Transportation*, January, 1960, p. 31. But it should be noted that the range of advantage for truck hauls has continued to rise as sturdier highways and technical innovations in trucking combine to permit larger payloads and resulting lower costs by highway.

industrial centres, a growth in short- and medium-haul trucking as a feeder service may be expected. In addition, operating on a terminal-to-terminal basis, piggyback will of necessity carry some trailers beyond their destination with delays in time and distance of delivery. Direct truck service by highway could have significant advantages in this respect.

From this it may be seen that the range for effective piggyback competition is not extensive, circumscribed as it is by efficient machine-loaded box car service on the one hand and by highway transport on the other. Of the two, truck competition appears likely to prove the most difficult to meet. This is partly because trucking has substantial advantages in some respects over TOFC. But mainly it is because of the rapid rate of improvement in the costs and services of trucking. These are likely to encroach steadily on those competitive advantages that TOFC now enjoys.

Competition with Trucking

General

The growth of piggyback transportation in Canada, following the growth of trucking, has been mainly in response to new and changing demands for faster, more specialized transport services. Changes in the organization and location of the industrial economy, changes in the composition of freight traffic (a larger proportion is more highly-fabricated, more valuable, more perishable and higher rated than in the past), the increasing importance of inventory costs and new developments in transport equipment and facilities have all supported this growing shipper demand for more speed and service in Canadian transport as well as the willingness of shippers to pay higher rates for these special services.

In dealing with the services provided by piggyback, therefore, it is important to consider the competition of piggyback with highway trucking. In the ten years from 1949 to 1958, highway carriers' share of total intercity freight traffic (in ton-miles) rose from 7.2 to 11.1 per cent, an increase of 138 per cent by volume. In the same period, the railways' share of this freight traffic fell from 68.1 to 52.3 per cent although the volume increased by 18 per cent. Piggyback services were looked upon as a means of halting this decline in the relative share of the railways. But by 1960, piggyback was carrying only about 2 per cent of intercity freight traffic.

Trucking, because of its greater flexibility and adaptability to the particular needs of individual shippers, was better equipped than railway box car services to meet the new demands of the transportation economy as they arose in the past. As a result, shippers had turned to trucking, especially in the decade of the 1950's, for these specialized services. Truckers were able to take over virtually all of what is called short-haul traffic (i.e., up to 100 to 200 miles) and a large portion of the medium-haul traffic (e.g., up to 500 to 600 miles). Until the last decade or more, the railways had been able to meet the competition of trucks for traffic that required longer hauls than these. But mainly since 1950, trucks have offered increasing competition in long-haul transport also, especially for perishable products and high-value, highly-fabricated products that demand special speed and service.

Pipelines and air transport have also encroached on railway freight traffic in this recent period. A major feature of these alternative methods of transport was their ability to provide carrier service that was better adapted to the particular needs of shippers than the more generalized railway services. Lower costs have, of course, been an important factor also, particularly in short-haul trucking and in pipeline competition.

This continued decline in the railways' share of traffic illustrates the deficiencies in traditional freight shed and box car methods of handling freight

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under modern conditions that piggyback was designed to remedy. TOFC enabled the railways to gain some of the service innovations developed by truck transport and combine these with possible low line-haul costs by rail. Indications are that piggyback service can remedy some, though not all, of the important deficiencies of box car service in longer hauls. Piggyback might also give the railways some advantages over trucks in costs, for certain non-perishable traffic, particularly on large-volume movements between major industrial centres, though this is not always evident in TOFC rates.

Thus piggyback service is competing with trucking for that share of railway box car traffic that is suitable for handling in trailers, for the traffic now carried in medium and long hauls by trucks, as well as for new trailer traffic that may develop.

Cost Competition

In appraising competition between piggyback and direct highway transport both costs and services are relevant considerations. Most emphasis had been placed on the cost advantages of TOFC.[1]

Line-haul costs for piggyback have been variously estimated at one-quarter to one-half of truck costs.[2] An extensive United States study,[3] comparing truck costs with average box car costs, gives trucking a cost advantage only for hauls under 100 miles. Presumably this would enable TOFC, with costs lower than box car service, to compete effectively with trucks on hauls under 100 miles. But as the above evidence has shown, TOFC, in the main, can compete effectively with trucks only on hauls of 200 to 250 miles or more.

The basic weakness in these cost comparisons between TOFC and trucking was that careful costing of the two modes had not been carried out. In the main, the costs used for piggyback were the average railway line-haul costs which are low because 60 to 70 per cent of rail traffic is bulk, machine-loaded commodities that move in trainload volumes on fairly long hauls direct from origin to destination. The costs of these line-haul movements are low, about one cent per ton-mile. But these are not the costs encountered by piggyback which handles small shipments requiring more manual handling and considerable pick-up and delivery (P & D) services.

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[1] Reports in popular journals, apparently based only on opinion, indicate that piggyback can save for-hire truckers up to 40 per cent of their costs. See, for example, *Financial Post*, September 5, 1959, p. 21, and *Dun's Review and Modern Industry*, June, 1959, p. 74.

[2] See J. C. Lessard, *Transportation in Canada*, Ottawa, 1956, p. 81, where rail costs are estimated at 1.5 cents per ton-mile against truck costs of 5 to 6 cents a ton-mile. See also *Harper's Magazine*, March, 1957, p. 39, *Financial Post*, September 5, 1959, p. 21, and *Dun's Review and Modern Industry*, June, 1959, p. 63. In the latter, Professor Baker of Harvard University puts piggyback long-haul ton-mile costs at about half those of trucks.

[3] Meyer, *et al.*, p. 189 and following.

Complete costs of piggyback operations were not obtained in this study. But TOFC rates (which range from 3.6 cents, Montreal-Toronto, to 18 cents, Montreal-Ottawa, per ton-mile) indicate that costs would be substantially above these low line-haul railway rates for box car traffic. Box car costs appear low because most of this traffic is very heavy per unit of space, (ores, grain, lumber, etc.) the hauls are long and costs of pick-up and delivery (largely mechanized) are relatively small. Piggyback traffic is not normally as heavy per unit of space, hauls were mostly under 400 miles, and P & D costs including terminal loading and unloading are relatively high—probably half to two-thirds of the average all-inclusive costs per mile.

It may also be noted that these TOFC costs, clearly higher than costs for volume movements by box car, can only be attained by regular piggyback trainload movements from terminal-to-terminal. If less than trainload movements occur, or if stops for switching at intervening stations are made, etc., these TOFC costs rise considerably.

Turning to truck costs, it seems apparent that estimates of truck costs used for comparisons with TOFC have in many cases included both line-haul and P & D costs. Thus the Lessard study showed average costs for trucks in 1956 as 5 to 6 cents per ton-mile against rail line-haul costs of 1.5 cents a ton-mile.[1] The weakness of these data as a basis for line-haul costs by truck are illustrated in a special study of truck costs made in 1960-61.[2] This shows that, for short-medium truck hauls, line-haul costs averaged only 3.53 cents a ton-mile, while their P & D costs were 3.59 cents a ton-mile.[3] In other words, when P & D costs are eliminated to make truck costs comparable with TOFC,[4] line-haul costs are only about half as high as those commonly used in estimates of trucking costs.

These line-haul costs are significantly lower than TOFC rates (the lowest TOFC rate is 3.6 cents a ton-mile, Montreal-Toronto). The cost of loading and unloading at terminals would be an additional cost for piggyback. In these circumstances it seems apparent that these TOFC rates would need to be very much higher than piggyback costs to give a cost advantage to piggyback over trucking.[5] Rates by direct highway were commonly equivalent to those by TOFC (both for Plan I & II).

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[1] United States references noted above appear to use the same basis of comparison.

[2] See *Truck-Rail Competition in Canada,* in this volume, in particular the Section on Truck Costs.

[3] In long-haul trucking, line-haul costs averaged 2.94 cents a ton-mile and P & D averaged 0.31 cents.

[4] P & D costs by piggyback, including loading and unloading trailers at TOFC terminals, would ordinarily be somewhat higher than P & D costs by highway.

[5] Where the TOFC volume is low, e.g., less than regular trainload movements terminal-to-terminal, piggyback costs may be substantially higher than with trainload volumes. This may, in part, account for the high rates, for example, between Montreal and Winnipeg (6.6 cents per ton-mile) and between Montreal and Ottawa (18 cents per ton-mile).

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It seems likely that if piggyback had significant cost advantages over highway service, the railways would take advantage of this to offer lower rates and thus draw traffic away from the independent trucking companies.[1] So far the railways have not been able to do this as may be indicated by the more rapid growth of trucking than piggyback since 1957. The TOFC movement of for-hire truck trailers between Montreal and Toronto has been interpreted as demonstrating a cost advantage by piggyback. But this was mainly the result of inadequate highway facilities especially near the Ontario-Quebec border.

A survey of major trucking firms in Canada[2] shows that firms that have carefully costed their comparable operations by piggyback and by highway have found substantial cost advantages in favour of highway service. On some 14 hauls in Ontario and Quebec, with various truck sizes and on various routes, the cost to trucking firms of using piggyback was on the average over 12 per cent higher per mile than direct highway service. On all of these hauls highway costs showed a cost advantage over costs by TOFC. The Montreal-Toronto route showed the least cost advantage by highway. It is on this route that the lowest TOFC rates are found.

The possibilities for piggyback to compete effectively with direct highway services appear to depend primarily on the ability of the railways to attract sufficient trailerloads to make regular two-way daily hauls of full trainloads of piggyback cars. Where this volume can be attracted, it may be possible that lower line-haul costs (and lower rates) will compensate in part for the extra costs and time required by trucking firms for delivering and picking up their trailers at TOFC terminals. Such trainload volume has developed on the Montreal-Toronto run.

Where full trainloads are not regularly available, and this was the situation on most TOFC routes in Canada in 1960, piggyback may have great difficulty in competing with direct highway service in costs and rates. Service competition may also be handicapped on routes where trainloads of trailers are not regularly available.

Service Competition

In this competition between TOFC and direct trucking, service is evidently a most important element. The advantage in service appears to be held by trucking firms even when they use piggyback for the line haul. The disadvantages of the railways in this respect may be illustrated by the rate

[1] Competitive advantages usually attributed to piggyback ordinarily place low line-haul costs (not rates) high on the list. But traffic managers for several leading Canadian shippers indicate that Plan II rates are comparable to highway rates and Plan I piggyback gives no rate advantage to the shipper over truck rates. See, for example, *Canadian Transportation,* August, 1959, p. 39.

[2] This survey was carried out as a part of the studies undertaken for the Royal Commission on Transportation. See *Truck-Rail Competition in Canada,* in this volume.

at which Plan I (trucker-owned trailers) piggyback has outstripped the growth of Plan II (rail-owned trailers). With the tariffs quoted to shippers under these two Plans virtually identical, truckers were able to provide 75 per cent of piggyback loadings by 1960.

At the same time, the volume growth of intercity highway operations has been more rapid than total piggyback growth. For example, highway transport increased its share of total intercity ton-miles by 2.4 per cent from 1957 to 1959. Piggyback, making its most rapid growth in this same period, increased its share by about 1.5 per cent.

From 1957 to 1959, the railways' share of total intercity traffic, including piggyback, fell by 2.6 per cent. These data indicate that the growth in piggyback in Canada may have been largely the result of such a sharp shift of intercity traffic to trucks that it was desirable for both the railways and trucking firms to support TOFC service for truckers. At any rate, most of the increase in piggyback was provided by trucking firms' trailers. Yet the railways thereby recovered some of the traffic they were losing while truckers gained supplementary facilities to handle part of their increasing volume. Most of the increase in truck traffic was moved by highway, however.

Viewed in relation to competitive services, this suggests that growth of piggyback in Canada since 1957, while much more rapid than in the United States,[1] is mainly an increase in the trucker-owned trailers that have been hauled. And it appears warranted to attribute this part of the increase more to the competitive advantage of truckers' services which enabled the trucking firms to gain the additional traffic in the first place than to the low cost of piggyback rates or to piggyback services. The evidence indicates that the railways were aware of these trends when TOFC services were opened to for-hire truckers late in 1957, and that the aim was to recapture some of the traffic they were losing to trucks.[2]

On the other hand, the tendency of intercity trucking to grow in the face of TOFC competition may be attributed in the main to advantages in services by truck over rail, including piggyback.

For example, some of the services supplied with piggyback are those that have regularly been provided for conventional box car service. Services and advice on rates, on claims, on special handling instructions, and such, are handled by the same people for piggyback as for other rail traffic. In the main they are reported to be less effectively handled than those provided by trucking companies. The tendencies toward inflexibility, bureaucracy and

[1] The best prospects for growth of TOFC in the U.S. are reported to be in Plans III and IV. As in Canada, the growth of piggyback using rail-owned trailers (Plan II) has been relatively slow. Truckers or the shippers themselves appear to have major advantages over the railways in providing pickup, delivery and other transport services, other than hauling.

[2] For example, H. B. Parr, assistant freight traffic manager, CNR, stated, "We've found that competition of reduced boxcar rates, coupled with Plan II piggyback has given truckers extra incentive to use Plan I service". *Railway Age*, January 4, 1958.

emphasis on regulations and precedents rather than service, which have been a mark of standard rail services for many years, are not fully eliminated in piggyback service, although some progress has been made.[1]

Trucking companies have built up a reputation for readiness to provide individualized services, to discuss and advise on rates, to establish special rates quickly when necessary, to settle claims promptly and to ensure that the special instructions of the shipper are carefully carried out. Having the same driver from the beginning to the end of the trip, especially for perishables or high-valued traffic, may insure that shippers' instructions are more carefully interpreted and that individuals can be held directly responsible for failure to follow instructions. Piggyback trailers have at least three separate persons responsible for hauling them on each trip but highway transport ordinarily has only one. In general, the intercity transport drivers, especially those on long hauls, are better paid and usually better qualified than most truck drivers. Part of the advantage enjoyed by trucking companies over railways can be attributed to the extra attention given to the shippers' interests by these special driver-salesmen. This personal attention can thus be carried through from the shipper to the consignee. This means not only better public relations for the truckers but also that shippers get first hand encouragement to direct new business their way.

Another disadvantage for shippers is that piggyback does not provide service to many stations intervening between major industrial centres. The railways have been slow to extend service to these on-line cities,[2] no doubt because it would either be excessively costly to make special shipments or would slow down the point-to-point service by stops for switching. Piggyback's success depends on avoiding both of these, i.e., higher costs and delays, if it is to compete with trucking services.

Development of satisfactory TOFC service (and probably rates) appears then to depend mainly upon the volume of potential traffic and the degree of highway congestion. Thus, for Montreal-Toronto traffic the rates may be relatively low and the service highly satisfactory. But for routes with a lower traffic volume, development can be expected to be slower, rates probably higher and the service advantages of using them correspondingly less.

Piggyback competes best where full trains of trailers (Figure 6) can be shipped regularly each day or night, where such trains make no stops for switching at intervening points and where such full train traffic is in fairly close balance both ways. Only a few routes in Canada can meet these requirements yet. For those that do, piggyback has provided a valuable service, especially on those routes where highways are congested.

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[1] That the railways recognize this problem may be indicated in their practice of leaving the management of purchased trucking firms in the hands of the former operators.

[2] *Railway Age*, January 13, 1958, p. 15.

Figure 6

At the same time, such point-to-point service leaves a considerable volume of traffic, destined for intervening points, that can only be handled effectively by trucks. In addition, for traffic destined for points closer to the origin than the piggyback terminal, direct shipment by truck may have substantial advantages in speed of delivery and in costs over piggyback. In this case, piggyback would require both extra loading and unloading of the trailer and greater mileage. It is in this area also that long-distance trucking has extra advantages over piggyback. The expansion of piggyback will tend thus to support long-distance trucking in this sector.

To for-hire trucking firms, however, piggyback had both advantages and disadvantages. The survey of trucking firms carried out for the Royal Commission indicated, from an overall view, that TOFC service would continue to be used by for-hire truckers but that its use would be limited to special rather than general traffic conditions.

The major disadvantages of piggyback to these trucking firms were that it was too costly relative to highway movements; that it could lead to a loss of their independence or the dominance of truckers by the railways; that overall it was slower than service by highway; that scheduling dock and P & D operations was more costly and difficult with piggyback; that TOFC service was less flexible than highway; that it provided little supervision and control of refrigeration; that it required more trailers than highway service required; that there was less opportunity for technological and cost improvements; and that trucking management lost some control over the services (speed, flexibility, etc.) provided to the shipper.

Against these disadvantages trucking firms reported some substantial advantages to be gained from piggyback. These advantages of piggyback were its benefits as a supplementary source of hauling power in special circumstances (e.g., peak load periods, for heavy or large-size loads, in "frost" periods, etc.); expansion of operations could be accomplished with a smaller investment; it permitted Sunday movements and extended Monday morning deliveries; trailers could be rebalanced between terminals without using tractors; there might be less exposure to accidents although insurance rates had not been reduced on this account; difficulties of adverse weather could be shifted to the railways; and some costs (e.g., licences) might eventually be reduced.

This survey of truckers showed that, after about three years of Plan I piggyback, much of their earlier enthusiasm for TOFC had been dissipated. The result was that the net gains and losses from use of piggyback were being more carefully calculated. Few firms had plans for any large-scale use of TOFC, most planned to confine its use more to special cases and many planned to reduce their piggyback when highway facilities improved, especially those between Montreal and Toronto. Yet it seemed evident that if TOFC

rates were lowered or if highway conditions became more congested, or both, trucking firms would tend to increase their use of piggyback.

In summary, it may be seen that the service advantages of piggyback accrue perhaps more to the railways and trucking companies than to shippers. As far as service to shippers is concerned rail-owned TOFC (Plan II), which was about 25 per cent of piggyback handlings, had the disadvantage that some of its services (e.g., rate information, claim settlements, etc.) continued to follow the traditional railway pattern. On the other hand, TOFC services provided by rail-owned trucking companies (about 25 per cent of total handlings) does not suffer from these disadvantages because in the main these companies have been allowed by the railways to operate like independent for-hire truckers. The other 50 per cent of the trailers carried by piggyback are provided by independent truckers. In this case, as in the former, shippers see no difference in the service whether it goes by TOFC or highway. Yet, normally, highway service would appear to offer shippers some advantages over rail-owned (Plan II) piggyback.

On the other hand, for the railways and trucking firms, piggyback has been providing some important services. The railways have thereby been able to retain traffic they would otherwise have lost and to gain some new traffic through the acquisition of truck lines or through independent truckers faced with special conditions of congested highways, peak traffic, special or heavy loads of dry freight, etc.

As for independent trucking firms, aside from their use of TOFC under these special conditions, the disadvantages of piggyback services and costs appear to outweigh its advantages except for a limited volume of traffic. This indicates, assuming present TOFC rates are not reduced, that there is little likelihood of piggyback service supplanting highway operations for regular day-to-day traffic beyond these special requirements. The delays and other costs involved in moving trailers to the TOFC terminals, in loading and unloading at the ramps, in making up and starting piggyback trains constitute a major disadvantage in this respect.

Yet two considerations suggest the importance of the railways retaining the support of for-hire trucking on piggyback. The first consideration is that for TOFC operations to be efficient and profitable a fairly large (trainload) TOFC movement between terminals must be maintained. To ensure they have this necessary volume, the railways may need to depend for some time on the 50 per cent share of TOFC traffic now provided by independent for-hire truckers. Whether this Plan I traffic can be retained by the railways depends on several factors—on how soon the highway congestion between Montreal and Toronto is relieved, on whether TOFC rates on other routes are reduced, on the rate of growth in demand for trucking services and others.

The Changing Pattern of Overland Transport

It will now be evident that, at the beginning of the 1960's, overland transport in Canada was in a stage of fairly rapid transition. The rapid growth of both piggyback and highway services, much of it at the expense of conventional box car traffic, are a measure of this change in the transport pattern. The major influences responsible for this continuing transition were the changes in conditions of competition—changes in costs and changes in the demand for, and supply of, transport services. In the long run, these changes in competitive conditions may be expected to alter the transport pattern further.

The trends in this direction are already becoming apparent. The competitive advantages of the railways in retaining their bulk, machine-loaded, trainload traffic may be expected to be maintained for some years. But the recent branching out of the railways into medium- and long-haul highway operations is a fairly clear indication they do not expect piggyback and conventional box car services alone to maintain their current share of traffic in the face of independent highway competition.

This conclusion is suggested also by the continuing decline of the rail share of intercity traffic, in spite of the development of TOFC service, as well as the railways' great efforts to modernize their facilities and services and make them more efficient. Part of this loss of railway freight has been the bulk traffic lost to pipelines and to water transport, including the Seaway. Part of the loss has been the traffic that has shifted to air transport and trucks. The traffic loss to trucks has been most significant because it is large and much of it has been the high-rated traffic on which the railways depended mainly for their profit.

Piggyback as well as railway modernization have tended to slow down the railways' loss of this traffic—piggyback by providing more competition in speed and service with trucks; modernization by enabling the railways to decrease the losses of bulk traffic to pipelines and water carriers.[1]

Yet truck transportation has continued to make substantial progress in drawing traffic away from the railways in spite of poor highways, load restrictions that greatly increase ton-mile costs and rates that must be charged to cover these costs. Indications are, however, that the trucking industry may have the advantage in future gains from technological improvements. Opportunities for traffic-attracting improvements from now on are likely to lie more with highway (and air) transport than with the railways.[2] The pro-

[1] With dieselization and other improvements the average CPR freight-train load was increased by 500 tons since 1947 and the train speed went up 26 per cent, giving a 65 per cent increase in ton-miles per freight-train hour. See N. R. Crump, *Western Business and Industry*, August, 1959, p. 33.

[2] Pipeline traffic should also continue to grow rapidly of course, and water transport should expand as Seaway facilities come into wider use.

posed extensions of the Trans-Canada highway system, the construction of throughways to eliminate traffic congestion, the development of tougher, less brittle pavements and the improvement of tractor and trailer units for truck transport appear destined, when combined with the numerous other innovations available to truckers in handling and service, to open for highway carriers many new avenues for rapid growth and expansion within the next decade.[1]

Piggyback has been injected into this competition between railways and trucks. But it would be wrong to assume that it has been a weapon directed by the railways with telling effect against truck competition. In fact, piggyback in Canada made little progress until the major independent trucking companies sponsored its extension to serve for-hire highway carriers.

In this dual role piggyback has been an effective supplement to the services of both railways and trucking companies. For the railways, piggyback has enabled them to hold much of the less-than-carlot traffic that had not been eroded away by truckers. It enabled them to develop pick-up and delivery services and feeder operations that could utilize line-haul rail facilities that were much lower in over-all cost than those available through conventional freight shed – box car services. It enabled them to hold and possibly to recover some of the high-profit traffic that has been most subject to truck competition. In the net result, piggyback has not been strong enough in competition to prevent the continued loss of the railways' share of traffic to independent trucking. But it has slowed the loss and has brought some new traffic by way of for-hire trailers (Plan I) to the railways. It may be expected to continue to play this important role as the railways extend their operations in the trucking field.

In trucking company operations piggyback plays a similar supplementary role. Most of its growth can be traced to this source. Piggyback has made it much easier for truckers to handle peak loads, to avoid congested highways and to expand operations by investing only in trailers. Piggyback can continue to serve for-hire trucking in these roles also.

In the main, piggyback growth in Canada may turn, as it has in the past, on the support given by independent for-hire trucking. It may be expected to expand also with the growth of the for-hire trucking subsidiaries of the railways. Chiefly because of this major emphasis on service to for-hire truckers, piggyback with containers may be relatively slow to expand in Canada. In the U.S., where containers hold promise of providing the means of standardizing a diversity of equipment, piggyback with containers may grow more rapidly.

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[1] Canada has not made as much progress in cross-country federally-supported highways and throughways as has the U.S. The development of trucking as a competitor of rail transport has lagged behind the U.S. development, as a result.

Trends and Prospects

These broad changes developing in the pattern of transportation in Canada are the consequence of powerful and continuing influences operating in the economy.

Changes in the demand for and supply of transport services will be among the most dominant of these influences on transport. Shippers' demands for faster delivery, smaller and more frequent shipments, and more specialized and individualized service may be expected to expand, probably at an accelerated rate. Labour and other operating and investment costs will continue to be a major stimulus to transport agencies to reduce manual handling operations and costs to a minimum. Both of these, i.e., demands for more service and rising costs of handling, will support and maintain the shift of traffic from conventional box car services to piggyback and highway transport. L.C.L. traffic is likely to shift entirely from box cars within the next few years.

This movement from box car to piggyback and truck should accelerate during the next several years as more of the higher-rated traffic (manufactures, etc.) seeks the services of for-hire trailers. After that it will tend to slow down, as box car traffic becomes reduced mainly to bulk, machine-loaded commodities that can be handled most economically and conveniently by box or gondola rail car. Altogether, it has been indicated, as much as 25 per cent of current conventional rail box car traffic may move to truck and piggyback. The Royal Commission on Canada's Economic Prospects estimated that the railways' share of total for-hire transportation would fall from 50.8 per cent in 1960 to 44.9 per cent in 1970. Most of this loss would go to highway transport. But while trucks may attract the lion's share of the traffic lost by conventional rail services, a very substantial share will go to piggyback also.

A second major influence on the future transportation pattern will be a big expansion in the over-all demand for transport in Canada. The Gordon Commission estimated that total for-hire transportation will increase by 30 per cent from 1960 to 1965 and by another 28 per cent by 1970.[1] Much of this increase is expected to be in manufactures and other high-rated traffic which should expand the share of truck and piggyback traffic. A substantial increase in oil and gas traffic should expand pipeline movements.

In addition to this over-all growth in transport, the nature of transportation will continue to change in response to increased industrialization, urbanization and the concentration of industry around metropolitan market

[1] Based on direct cost estimates. See *Final Report,* Royal Commission on Canada's Economic Prospects, November, 1957, page 283. U.S. transport requirements are expected to rise by 33 per cent from 1959 to 1965. See *Dun's Review and Modern Industry,* June, 1959, p. 60.

areas. These will go hand in hand with an expanded production of highly fabricated, high-value products and increase the demand for specialized transport services such as for-hire trucking has developed.

The division of this increased traffic between piggyback and truck will, of course, depend to a significant extent on the rate of highway development in Canada and on whether piggyback rates are revised downward relative to truck costs and rates.

Where highway construction lags behind the growth of freight traffic, highway congestion will result and more of the trailer traffic may tend to be shipped by piggyback.

Indications are that highway development will proceed faster in the future than it has in the past. The early completion of the Trans-Canada highway, the prospect that it may be soon extended, the continued expansion of throughways and superhighways and the rapid increase in total vehicle traffic that presses for even more and better highways, all point to a substantial long-run improvement in conditions for both local and long-distance trucking. Until this improvement occurs, increasing highway congestion will support the expansion of piggyback. As more superhighways are built and interprovincial highways are improved, the advantages of direct truck delivery will also improve and tend to lessen the dependence on piggyback as a means of circumventing road bottlenecks. In the meantime, piggyback may be looked upon as providing a useful alternative service during the transition—an alternative for both independent and rail-owned trucking companies.

Perhaps this may also explain partly the apparent discrimination in piggyback rates. If it does, it would suggest that these rates have been established at levels that are competitive with highway costs only on those routes (e.g., Montreal-Toronto) where the volume in the long run will be adequate to maintain trainload TOFC service. Looking thus toward long-run competition between highway and piggyback services, it seems unlikely that current piggyback rates would be modified downward.

Overall, while the demand for transport grows in Canada, the competitive structure and the comparative advantages of the various types of transport may be expected to change at the same time. The speed of these competitive changes has not been estimated here beyond those made by the Gordon Commission above. But the general direction of the competitive outcome may be broadly indicated.

Of chief concern here, in this respect, is the competition in overland transport, yet within the fields they serve, water, air and pipeline transport may be expected to change also. But water transport while large (it was 23.2 per cent of intercity ton-miles transported in Canada in 1958) is confined mainly to bulk, low-value traffic for which speedy delivery is not a major consideration. Air transport still plays a very small role in total freight

handling in Canada. Pipelines have attracted the major volumes of oil and gas traffic but their field of competition has not reached beyond these yet in Canada.

Within the field of box car, piggyback and highway transport the competition promises to be keen during the next decade at least. It may take several years before a clear pattern for division of the traffic becomes generally established. But taking the long-run view, the competitive conditions of services and costs already indicate an identifiable pattern for the distribution of overland freight traffic.

The standard box car and gondola services will tend in the long run to handle mainly the bulk, mechanically loaded, relatively low-valued traffic like iron ore, coal and other mineral products, wheat for export and some forest products which can be hauled in trainload lots. Rail transport should retain this traffic for years unless water transport or pipelines (in some cases) are able to compete with it. This type of traffic may well maintain a substantial and increasing volume of handlings for the railways. Since it can be handled on a trainload basis, costs may be kept low enough to make it profitable even though it is low-rated traffic. The key to profits on this may well depend on making trainload through-hauls with switching and other lost time reduced to a minimum.

The most profitable of current box car traffic (manufactured goods, perishable farm products, etc.) will tend to demand highway and piggyback services, with most of it going to direct highway transport but some of it, especially where highways are inadequate going to piggyback for the time being. Because of these traffic losses to highway transport the railways will undoubtedly experience increasing difficulties in getting their operations on a profitable basis, even with the help of a profitable piggyback service, because piggyback may not reach beyond 10 to 15 per cent of total rail traffic, in the long run.

As a result of the continuing expansion of highway facilities, the technological improvements in highway freight equipment, the relative reduction in costs of trucking, and the continuing growth in demand for the more flexible and more specialized transport services that truckers can provide, the long-run tendency will be for a major expansion in highway trucking services. The volume of this expansion may be most marked at the medium-haul level as truck transport continues to extend its clear area of advantage over rail services (both piggyback and box car) from the present short (up to 250 miles) to medium (up to 500 miles) hauls, except where highway congestion may swing the advantage to piggyback.

But while medium-haul trucking may be expected to grow most in volume during the next few years, the most rapid *rate* of growth is likely to be in long-haul highway operations, as has been shown in another study in

this volume. This continuing rapid competitive growth of long-distance trucking will reach further into an area of traffic which, until a few years ago, seemed reserved indefinitely to the railways. This encroachment on the last bastion of long-haul traffic has demonstrated, probably more clearly than any other factor, the relative decline in the competitive strength of the railways.

The demand for individualized and specialized transport services will continue to support extension of longer distance trucking. This demand will tend to be met in the main by for-hire truckers but it will be met also by shippers' private trucking services more than has been the case in the past.

This expanding role for trucking in overland transport and the parallel decline in the role of rail transport, at least in box car traffic, can be traced in the record of traffic changes that have already taken place. Indications that the railways recognize the significance of these trends are evident in the recent extensive investment by Canada's two railways in trucking companies, several of which are engaged mainly in long- and medium-distance hauling. Their choice in this respect indicates the railways have not purchased them entirely for pick-up and delivery purposes as feeder services for piggyback but also to engage in direct medium- and long-haul highway transport. These moves by the railways appear to have clear implications for the future of overland transport in Canada. They indicate that the long-run advantage tends to lie with highway transport. This has been confirmed by some senior railway officials.[1]

This does not mean that the role of piggyback will be short-lived and small. In fact, TOFC may continue to play a very important part. It may, for example, be an area of major profit prospects which makes it feasible for some railway operations to become financially sound again. It will, for the time being, be the major line of defence of the railways against competition from non-rail truckers for L.C.L. and box car traffic. It will provide a service that is useful both to for-hire truckers who may use it and the railways who provide it. For the long-haul traffic on which somewhat less speed, service and care is required than long-distance trucking usually provides, piggyback can probably meet shippers' needs effectively and at lower costs, though here cost advantages may depend on rate adjustments.

Piggyback may also develop a substantial role in low traffic areas. It has already been combined with trucking to provide many communities in the Maritimes with improved service.

Thus the role for piggyback in supplementing conventional rail services on the one hand and highway service on the other, is likely to continue to be important for future years. Its growth rate has levelled off and will be slower than it has been in the past.

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[1] Dr. O. M. Solandt and A. H. Hart, both CNR vice-presidents, have indicated this in recent statements.

Thus piggyback could well reach 10 per cent or more of total rail carloadings by 1965. This may not be enough to equal the railways' loss of traffic to highway trucking but it will offset some of it. Growth of the railway companies' trucking operations may compensate for some more of it.

U.S. PIGGYBACK PLANS

PLAN I: Railroads and motor common carriers

Plan I—Railroads carry trailers owned by motor common carriers, on a "division" of the truck rate—actually in practice a flat charge per trailer based on weight and distance, regardless of commodity. The trucker solicits and bills all freight at truck rates; takes trailers to, and picks them up from, railroad piggyback terminals; and performs any required road-haul before or after the rail movement. The railroad has no direct contact with the shipper, and simply substitutes for the trucker on part or all of the total road-haul.

PLAN II: A railroad operation, door-to-door

Plan II—Railroads carry their own trailers, under their own truck-competitive tariffs. Under this all-rail plan, the railroad deals directly with shippers; furnishes all equipment; and provides pick-up and delivery between shipper plants and rail terminals, either by railroad-owned tractors or by contract with local draymen. P & D is usually confined to established territories contiguous to rail terminals.

PLAN III: Shipper trailers, rail cars

Plan III—Railroads carry trailers owned or leased by shippers, at a flat rate per mile. The shipper delivers trailers to railhead; the railroad puts them aboard flat cars, ties them down, transports them to destination and grounds them; the shipper picks them up at the rail terminal.

PLAN IV: Shipper trailers, shipper cars

Plan IV—Railroads carry trailers owned or leased by shippers on flat cars also owned or leased by shippers, at a flat charge per car, whether trailers are loaded or empty. The shipper takes his trailers to and from the rail terminal, and loads and unloads cars. The railroad performs terminal-to-terminal line-haul movement only.

PLAN V: Joint rates, truck-rail-truck

Plan V—Railroads carry their own trailers, or common-carrier truck trailers, under joint rail-truck rates on an end-to-end basis. Operationally, Plan V is similar to Plan I, but is a true joint operation, which, in effect, extends the territory of each participating carrier into that served by the other; permits each participant to handle shipments originating in or destined to the other's territory; and allows each to sell for the other. Normally, this plan involves a truck road-haul on one or both ends of the rail movement.

SOURCE: *Railway Age,* March 28, 1960, p. 74.

Excerpts from Study of Cost Structures and Cost Finding Procedures in the Regulated Transportation Industries

by

R. L. BANKS & ASSOCIATES
Transportation Consultants
1001 15th Street, N.W.
Washington 5, D.C.

Prepared for

UNITED STATES DEPARTMENT OF COMMERCE

NOVEMBER 1959

53744-9—11½

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Study of Cost Structures and Cost Finding Procedures

Preface

The following excerpts relating to cost concepts in transportation, and certain relationships between them, are taken from a special study prepared for the United States Department of Commerce in November, 1959, by R. L. Banks & Associates of Washington, D.C. Since the study is, as yet, not generally available to the public, we sought permission to publish relevant portions which were particularly useful to an understanding of many of the cost concepts related to our conclusions.

Omissions from the original in this portion of the study have to do mainly with specific United States experience and examples. The omissions do not, in our opinion, alter the purpose or change the concepts found in the original document. However, for any inadvertent misconceptions caused by the abridgement, we take responsibility.

We acknowledge with gratitude the authors' permission to reproduce these portions of a study which sets out the bases of a subject so often confused by definitional ambiguity.

Part One—The Place of Costs in Transport Policy

Section 1

Some Basic Concepts

By the term "cost" is meant the total expense, both cash and non-cash, incurred to sustain the operation of a transportation enterprise. This includes both replenishment of operating expenditure and return upon capital in amounts sufficient to attract investment as the need arises.

A knowledge of costs and their relationship to traffic and rates is basic to effective public policy and intelligent business behavior. But the cost knowledge essential to carrier management relates primarily to expenditures of the transportation firm itself, whereas the proper concern of regulatory bodies comprehends cost incurred both within and outside the individual firm.

For meaningful administration of their public duties, regulatory bodies must concern themselves not merely with carrier cost, but also with inter-

carrier and intermodal cost comparisons. Likewise they are required to weigh the cost elements of time, risk and obsolescence embodied in consumer evaluation of service. Finally, they need to consider these transportation costs not charged directly through carrier books of account, but assumed instead by government.

The differences between carrier and regulatory concern with costs serve to emphasize a point essential to fuller understanding: costs are highly complicated phenomena which vary widely under differing circumstances, and are frequently difficult if not impossible to measure with precision. Accordingly, the cost which is significant varies from one situation to another. Therefore, meaningful cost analysis always starts with the question: What purpose are these costs to serve?

The point is perhaps best illustrated by a brief examination of the differences between corporate and public cost usage. Corporate cost knowledge is required by the profit incentive which underlies the existence of the firm. In this framework cost analysis is essential, since it provides the only effective means for control of expense, and for its measurement against revenue in profit determination. . . .

Regulatory bodies, by contrast, use cost knowledge to fulfill their obligation to ensure that the public is provided with safe, adequate, economical and non-discriminatory service. Since competition is, in theory, the device employed to attain these objectives, and since costs and rates would be equal under conditions of perfect competition, cost analysis provides regulatory agencies with a means to assess the competitive imperfections indicated by undue margins between costs and rates . . . .

Despite the implications of cost for both corporate and public policy in transportation, an awareness of its central significance has been a relatively recent development. This has been a result of displacement of the railroads from their former predominance of inland transportation. Prior to the development of motor carriers, pipelines, and airlines, the railroads had only water competition, and that embraced but a minor fraction of their operations. As a practical matter rail transportation operated under conditions of monopolistic competition (i.e., few sellers and many buyers) at many traffic points. . . .

Section 2. (Deleted. *See* Preface)

Section 3

Cost Limitations

The meaningful application of specific costs to particular situations in transport regulation has lagged substantially behind the growing awareness of the implications of "cost" for rate levels, traffic volumes, and service standards. There are four basic reasons for this.

Absolute Precision Unattainable. First, many transportation costs, even those which have already been incurred, cannot be measured with complete precision and related to components of traffic. The classic example of this is maintenance expense attaching to intercity traffic ways, which for railroads, highways and waterways is a function of both the passage of time and traffic volume. The physical plant of these traffic channels is exposed to action of the elements and to the passage of traffic. Drainage systems become clogged, embankments erode, the impact of rain, snow and frost necessitates offsetting expenditure to keep channels open, highways smooth and tracks aligned in a manner suitable for passage of traffic. But passage of traffic itself contributes to erosion, through impact on road surfaces, wear on rails and wash against channel embankments. A continuing and largely unresolved issue has centered about attempts to define the proportion of way maintenance cost properly chargeable to traffic and time, respectively, and once the latter is isolated, its appropriate attachment to traffic components.

By contrast, other transportation costs can be traced directly to their source. Most costs of vehicular movement, such as fuel and wages of operating personnel, can be determined with adequate accuracy and related to the traffic to which they pertain.

Thus some transportation costs can be assigned directly to traffic and others cannot, although they are apportioned or distributed amongst traffic or user groups by more or less arbitrary methods, which attempt compromise between theory and experience, between mathematics and empirical observation. The objective of cost analysis is to isolate cause and effect relationships; that is, to find out what costs are incurred by doing a specific thing. Some costs are simply *not* caused by doing a specific thing, but are caused by doing many things. The question of how these latter "must" be apportioned or distributed amongst traffic or user groups is not a question of *cost* analysis, but rather a policy question of how much overhead can or should be collected from particular users. This is pricing, not costing. Where costs of both types, assigned and apportioned, are inseparably mixed, and together relate to the production of multiple services, as in railroad transportation, for example, meaningful cost derivation becomes somewhat obscured in a mass of involved computations and complex numbers which lend a not altogether justified air of precision to the computed results.

Difficulty in Relating Past to Future. Second, meaningful cost development has also been hindered by the difficulties inherent in relating past cost experience to future operating results. Excepting only past period subsidy ascertainment in air transport, the appropriate costs for consideration in either rate or service (i.e., public convenience and necessity) cases, are *future* costs. In either situation the relevant question *always* is: "What will be the change in future total profit (future total revenue minus future total cost) as

a result of the proposed change in price or service?" Very obviously, the starting point for determining future costs is past cost. These past costs must be adjusted for known or anticipated changes in price-levels, operating conditions, technology, and the general economic situation. It is often stated that these adjustments are just guesses, and so they are. It is well to remember, however, that the simple extrapolation of past data, despite all of the seeming arithmetic precision which surrounds it—may be of limited pertinence to the future.

Past data, then, are only the starting point in estimating future costs. In order for these to be a useful starting place, it must be decided whether the most recent period of time or a longer period will provide the most useful basis for projections. In any cost estimate this will clearly depend on the relevant length of the projection. This is, to project one month ahead, data for the most recent month will most likely be more relevant than those relating to any other previous month (except, perhaps, in cases of pronounced seasonality). By the same token, data for the most recent month will hardly be relevant to a projection into the indefinite future.

It seems apparent that most regulatory proceedings, whether they concern price changes or service adjustments, relate to an indefinitely long future. An abandonment is clearly a rather permanent and long-run act, as is the institution of service to a previously unserved route or point. A price change is not permanent, but a new freight rate is usually expected to govern for a fairly long period. The future costs and revenues relevant to a regulatory appraisal of these decisions must be long-run, and consequently, the past costs used as a basis for these predictions should be long-run. To the extent that the past is relevant to the future, it is clearly the *typical* past that is relevant for whatever period of time is involved. For a long-run future, the past month or six months or year is unlikely to be *typical.*

Thus meaningful cost development for most regulatory purposes relates to the future primarily. Where inadequate selection of the typical past is compounded by inadequate adjustment to reflect future operating conditions, and to this is added the ingredient of insufficient market information, computed results must necessarily diverge from actual cost.

Absence of Defined Cost Standards. Third, ignoring for the moment the technical difficulties described above, it can be observed that the development of meaningful cost data has been hindered in perhaps a more significant sense by conceptual uncertainties regarding not merely the costs themselves, but also the situations in which they may be appropriately applied. An illustrative example is the variety of bases relied upon in ICC rate proceedings to measure "out-of-pocket" (variable) railroad costs. The range of permitted

and presumably relevant data relied upon to establish this single significant cost level has included, among others:

(1) Directly assignable cost only.
(2) Directly assignable cost plus apportionments of indirect railway operating expenses.
(3) Directly assignable cost plus apportionments of indirect railway operating expenses, rents and taxes.
(4) Directly assignable cost, plus apportionments of (*a*) indirect railway operating expenses, rents and taxes, and (*b*) return on equipment.
(5) Directly assignable cost, plus apportionments of (*a*) indirect railway operating expenses, rents and taxes and (*b*) return on road *and* equipment.

The proportion of out-of-pocket to total cost has of course varied with the method employed, with corresponding confusion in establishment of their pertinence to the situation assessed.

No single cost standard is suitable for the variety of rate cases which the Commission must adjudicate, but the absence of a policy pronouncement clearly definitive of those costs construed as relevant to various kinds of cases has very likely hindered meaningful cost ascertainment in this area.

In evaluating service adjustments, a similar obscurity has perplexed the participants. Various concepts such as "above the rail," "direct," "avoidable" and "fully apportioned" costs have been introduced and relied upon in rail service reduction or abandonment proceedings, and a like uncertainty as to costs properly attaching to the inauguration of new, or the suspension of existing service, beclouds the decisions of the Civil Aeronautics Board.

Value-of-Service. Fourth, in the quasi-judicial regulatory environment, cost becomes the one element of "fact" which can be challenged, analyzed and argued over. Cost calculations, because they involve mathematical processes, unfortunately create an illusion of precision, and the assumption is frequently made that costs can be measured with the same precision that one can measure a person's height and weight. "Either it takes 50 gallons of fuel to move a rig from here to there or it doesn't." Such treatment ignores the fact that on a large carrier there may, at any one point in time, be literally thousands of different things being done, and to sort out precisely the ultimate effect upon cost of any one of these things is virtually impossible. Such treatment, also indicates an ignorance of the fact that the measuring tools of the accountant, statistician and economist are far removed from the precise measuring tools of the physicist or engineer.

The price-maker knows that precise measurement is illusory, especially in terms of final future financial impact. The regulator may know this

too, but because he is cast in the role of impartial finder and arbiter of facts, he must discharge his responsibility to judge the "facts" of record. Therefore, a primary objective of future price regulation should be to attain a perspective on the place of costs in price-making and consequently in rate hearings.

Casting aside the imperfections in current cost ascertainment and presentations, the fact remains that were it possible in rate-making to ascertain with complete precision either the out-of-pocket (marginal) cost or the full (average total) cost of the service to be measured, neither would fully serve the regulatory purpose. As will later be shown, reliance solely upon average total cost pricing would hinder optimum utilization of the transport plant, whereas complete resort to marginal rates would produce revenues insufficient to cover total costs of the transport service. Another element therefore also enters into the development and execution of a socially desirable policy, namely, demand. As a reflection of market conditions and user judgments, demand factors, embodied in the so-called value of service concepts, must continue to supplement cost ascertainment for regulatory purposes. At the present time, however, there cannot be very much argument over price/volume estimates, because it soon becomes apparent that with the current state of knowledge about transport market forecasts, such argument centers more directly on guesswork. This points up the absence of adequate data for demand measurement; without it many cost computations must necessarily be of limited value to the regulatory agencies. In short, more balance is needed between cost and demand data development. . . .

Part Two—Transportation Cost Characteristics

Section 4

Cost Classification

Costs can be classified in several different ways. To assess their relationship to both economic objectives and to profit contribution, costs can usefully be compared in three different frameworks:

(*a*) Fixed costs versus variable costs. Fixed costs remain constant at virtually any traffic volume and over relatively long periods of time. Variable costs (all other costs) usually vary more or less in proportion to the volume of traffic.

(*b*) Common costs versus directly assignable. Common costs are incurred in the production of more than one type of service, thus can not be allocated* to any particular service. Directly assignable costs on the other hand are incurred in the production of only one type of service.

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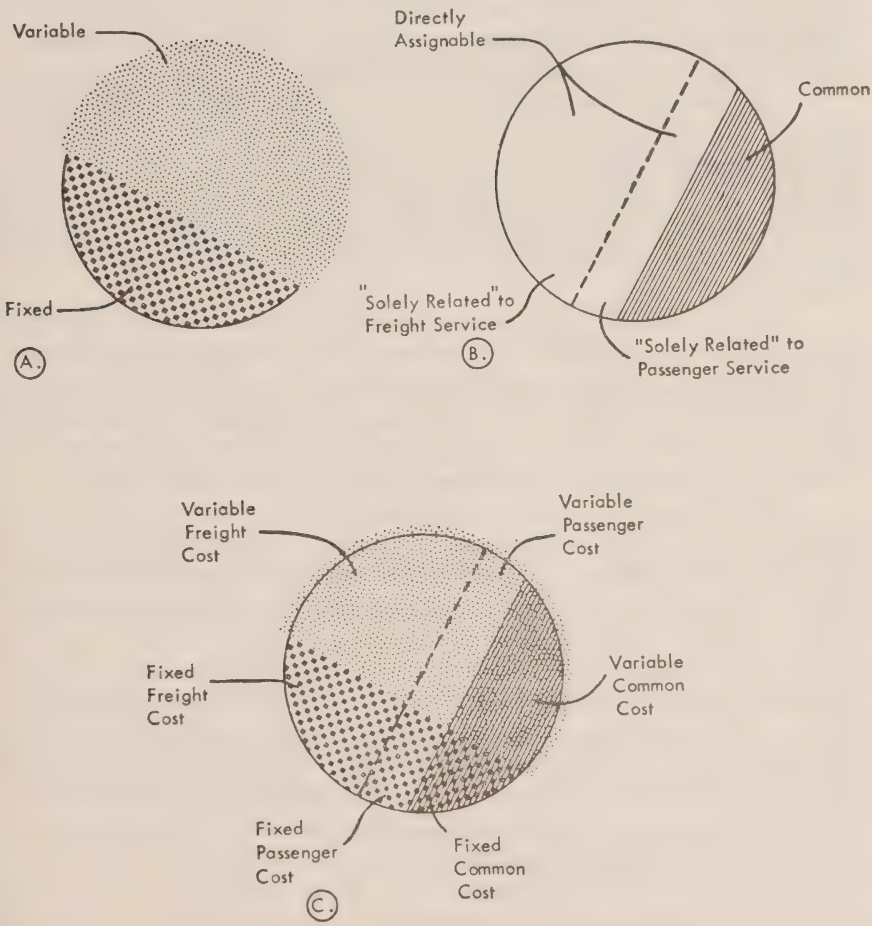
* directly

(*c*) Total costs versus costs per unit. Total costs are all the costs incurred by the firm, and may be segregated in the manner of (*a*) or (*b*) above. Cost per unit represents the association of specific costs with specific quantities of output (traffic).

It is important to remember that considerations (*a*) and (*b*) above involve no more than a different segregation of the same total cost. It is analogous to cutting the same pie in two different ways, as Figure 1 shows. Using railroad costs for illustration, total cost "A" is divided into its fixed and variable components. By contrast, "B" shows total cost divided between

Figure 1

TOTAL COST COMPONENTS



directly assignable costs and those incurred in common by more than one type of service. Directly assignable cost in "B" is further fragmented into components associated with freight and passenger service: these are designated as "solely related" costs. The two distinct separations of total cost shown in "A" and "B" are not mutually exclusive, and do not lose their particular characteristics when superimposed, as in "C".

In its exploration of cost characteristics and ascertainment, this report devotes relatively more attention to railroads than to other types of transportation. This emphasis is unrelated to the predominant historical position of the rail carriers, it originates rather in the basic and only useful purpose of transport cost analysis: to determine, in terms of cost, what occurs when a carrier handles, or ceases to handle, specific traffic. It happens that fulfilment of this basic purpose is more difficult for rail than other carriers due to (*a*) the large proportion of fixed and common costs inherent in the physical characteristics of the railroad plant, and (*b*) the resultant higher degree of complexity in associating rail costs with rail traffic.

To a markedly lesser extent fixed costs are also present in the air and water carrier industries. These likewise have a substantial element of common costs, but much of this is related to the government-built facilities which they use. Furthermore, the common costs of these carriers reflected in their current operating expense are predominantly associated with one major category of service or product, and not, as with the railroads, fragmented more equally between them.

With absence of ownership in their roadbed, and relatively small equipment units and capital requirements, motor carrier costing presents fewer technical handicaps to adequate cost-finding. The adjustment of capacity through addition or elimination of vehicle units facilitates identification of expenses with traffic, and limits the potential long-run economies of scale. Common costs are present, but occupy a much less prominent role.

These intermodal differences are fairly obvious, and have often been considered. By contrast, similarities which may be of equal or greater importance in their public policy consequences have received relatively less attention. These involve, first, potential discrepancies between user costs and user taxes relating to government provided facilities. This is an area much discussed about which relatively little is known, despite some strenuous but spotty efforts at measurement. Second, they include distribution costs which are a function of transportation use: inventory, packaging, warehousing, purchasing, risk, interest, obsolescence, and so forth. Here too, relatively little is known, but there have been incipient attempts at measurement which indicate the costing problem is not insuperable. Third, a consideration also of consequence is the impact of transportation upon land use, land values, urban congestion and the alternative uses of scarce human and material resources. Practically nothing has been done to measure costs attaching to

these interactions. The combined weight of these factors indicates that there is a substantial gap between the corporate and total economic cost of all types of transportation.

In a very real sense, therefore, the conventional scope of transportation costing deals with dimensions somewhat less than the all-inclusive economic cost of transportation. By the same token, therefore, intermodal cost comparisons based on available data are, and will continue to be, imprecise, pending the development of more sophisticated techniques for assessing costs not reflected on carrier books. However, since corporate costs provide the only readily available data, and probably constitute the largest fraction of total transportation costs, comparisons must necessarily be principally on this basis, despite the possible consequence that the results may be somewhat misleading. . . .

Section 5

Fixed and Variable Costs

One of the most elusive problems in transportation cost-finding is the separation of fixed from variable costs. As to both business in general and transportation in particular, the quantitative segregation into these two categories is of controlling significance in cost appraisal.

The General Case

Any business commits itself, *for a period of time,* to establishment. The costs of having this establishment (physical plant, *ad valorem* taxes, property protection, minimum supervisory staff, etc.) will be incurred during the lifetime of the establishment more or less independently of the extent of the activities which it carries on. This group of costs is called *fixed costs.*

During the life of the establishment, the business will engage in producing and selling its products or services. It will earn revenue from its sales and it will incur costs for producing and selling, which are *in addition to* the basic costs of the establishment. These costs are designated as *variable costs.*

If a company sells its products or services at a price which is greater than the variable costs incurred in producing and selling, it will have dollars left over to meet the costs of its establishment, i.e., fixed costs. If the process of production and sale with dollars left over is repeated sufficient times, the company will have enough dollars to meet the fixed costs, and dollars received in excess of both variable and fixed costs are profit.

Whether or not each turn of the production and sale cycle yields the same amount or proportion of dollars is irrelevant. Profitable operation depends on receiving more than enough of these marginal dollars, from what-

ever source, to meet the fixed establishment costs. It makes no difference that one particular product or service brings in half the marginal dollars required and the other half comes in varying amounts from a large number of products or services. Indeed, an attempt to collect a stated proportion of the fixed costs, i.e. to "fully distribute" costs may inadvertently lead to smaller profits. "Distribution" of a portion of fixed cost to variable product costs has nothing to do with the process of judging whether a price is compensatory; it is in itself a process of *price-making.*

The only test of compensativeness (looking not at the business as a whole, but rather at each specific kind of output or traffic) is to compare revenues (price times volume) with *variable* cost. To be sure, a company will lose money in the long run if it fails to cover its fixed costs out of the difference between revenue and variable cost. It avoids this, however, not by "distributing" these fixed costs but by maximizing the spread between the revenue from selling the service and the variable cost of producing the service.

"Distribution" of fixed cost to individual services is a method of price-fixing, and does not result in a relevant measure of cost. The only sound point of departure for the pricing process is a measure of variable cost.

The Transportation Case

The significance of fixed and variable costs and of their relationship to each other can best be stated in terms of a cost function. This describes, graphically or by formula, the relationship between cost expressed in dollars, and various levels of traffic expressed in physical output units (such as available ton-miles or gross ton-miles). Figure 2 illustrates such a cost function.

For a carrier of any given size, total cost (C_1 or C_2) is comprised of both fixed and variable elements, as can be seen by examining the costs at both T_1 and T_2 volumes of business. The "True Cost Function" shown in Figure 2 is a graphic statement of the total costs of the firm at various levels of business. At the present level of traffic (T_1) total costs are C_1; if the proposed traffic (T_2) were acquired, total cost would become C_2.

Fixed costs are so designated because they do not fluctuate in relation to the level of business. Whether at volume T_1 or T_2 or any other, fixed costs hold constant. Consider the significance of this characteristic as business increases from T_1 to T_2: fixed costs at T_2 are no larger than at T_1, but there are more units of output (or traffic) over which to spread them. The average fixed cost per unit has gone *down* at T_2.

Total variable cost, on the other hand, increases directly with increases in volume. For example, if the variable (or product) cost is $200 to carry 100

passengers, then it will cost $400 to carry 200 passengers. The variable cost here is $2.00 per passenger; the *total* variable cost is $2.00 times the number of passengers carried. Since variable costs vary directly* with volume (as we have assumed in our elementary model) the cost per unit remains constant, as illustrated by our $2.00 product cost per passenger. The rate of change ($2 per unit) is customarily called marginal cost.

These distinctions are of lesser consequence where technology permits the facile adaptation of cost to traffic, as with corporate expense incurred by air, motor and water carriers. They are of importance however, where inherent physical characteristics preclude short term adjustment of many cost components to traffic fluctuations, as in the rail and pipeline industries. Even with these however, there are indications that the plant size of a going concern can in the very long run, be adjusted to traffic volume.

What is the significance of fixed and variable costs? A separation into the two elements is essential for the determination of the True Cost Function, hence for the determination of the cost of additional or subtracted business. The significance of sizeable fixed costs is that after the variable costs have been met, there is a large residual which must also be covered if the firm is to have any net income. This residual can be covered in any way possible; no mathematical formula can determine how. In fact, the application of mathematical formulas to this particular problem can be a detriment to increasing net income.

The transport industries differ from each other in the composition of their fixed and variable costs, as Figure 3 illustrates. Industry A is typified by very low fixed costs at the typical volume of operation, whereas Industry B has high fixed costs. For Industry A the average cost function (total volume divided by total cost) is a fairly close approximation of the true cost function. But in Industry B the average cost function is a poor measure of true costs: for levels of business *below* the typical level it drastically understates costs, for additional business it drastically *overstates* the increased costs.

In the transportation industries the corporate cost behavior of airlines, most inland water carriers, and motor truckers resembles Industry A. This is so because their operations are conducted in small units, (trucks, vessels, planes), which are cost entities in themselves. As business increases, these firms purchase additional equipment. Most of the fixed costs in these technologies exist *outside* the firm; "conventional accounting" provides a satisfactory measure of their costs, since most costs can be meaningfully associated with a single production unit.

On the other hand, railroads and pipelines resemble Industry B. Large fixed costs are a prerequisite to operations: land for right-of-way, tracks, yards, pipelines, pumping stations, signal systems. Heavy volume is

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* and more or less proportionately

the only way to lessen the impact of these fixed costs. As a consequence of these characteristics, railroads pose by far the most complex cost analysis problem; until now pipelines have carried a limited number of commodities in which their cost advantage has been so markedly superior that little or no cost precision has seemed necessary.

Figure 2

SIMPLE COST FUNCTION

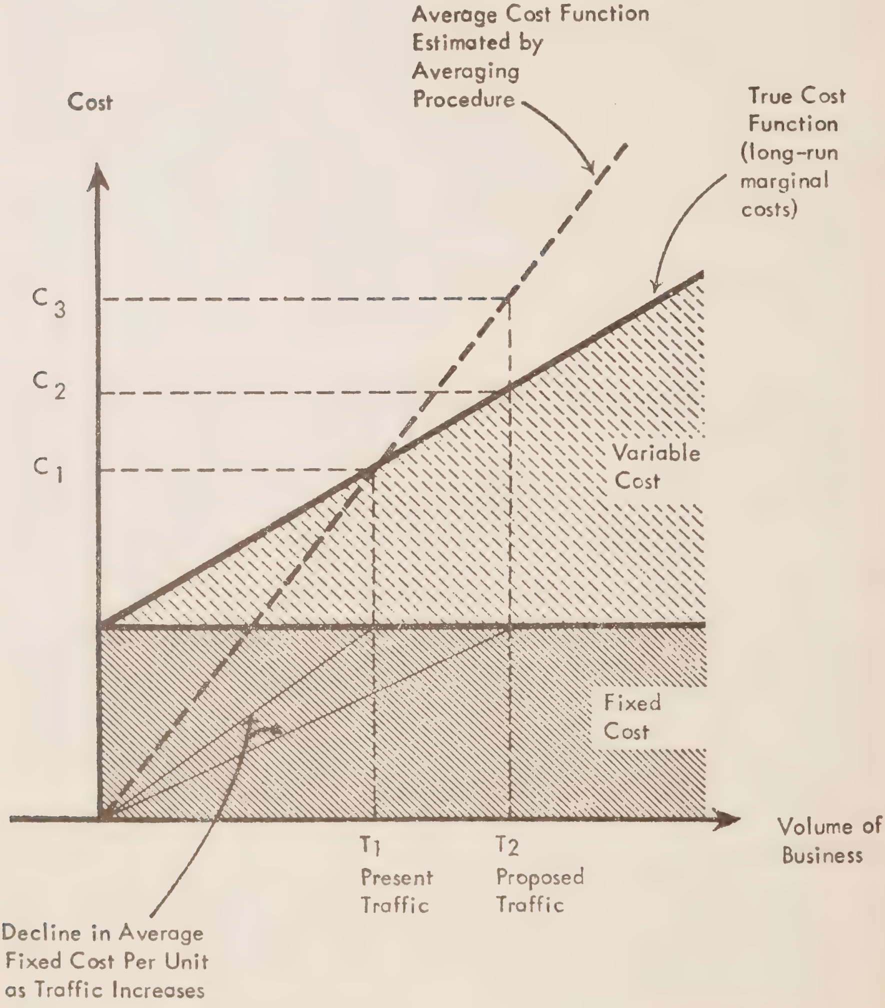
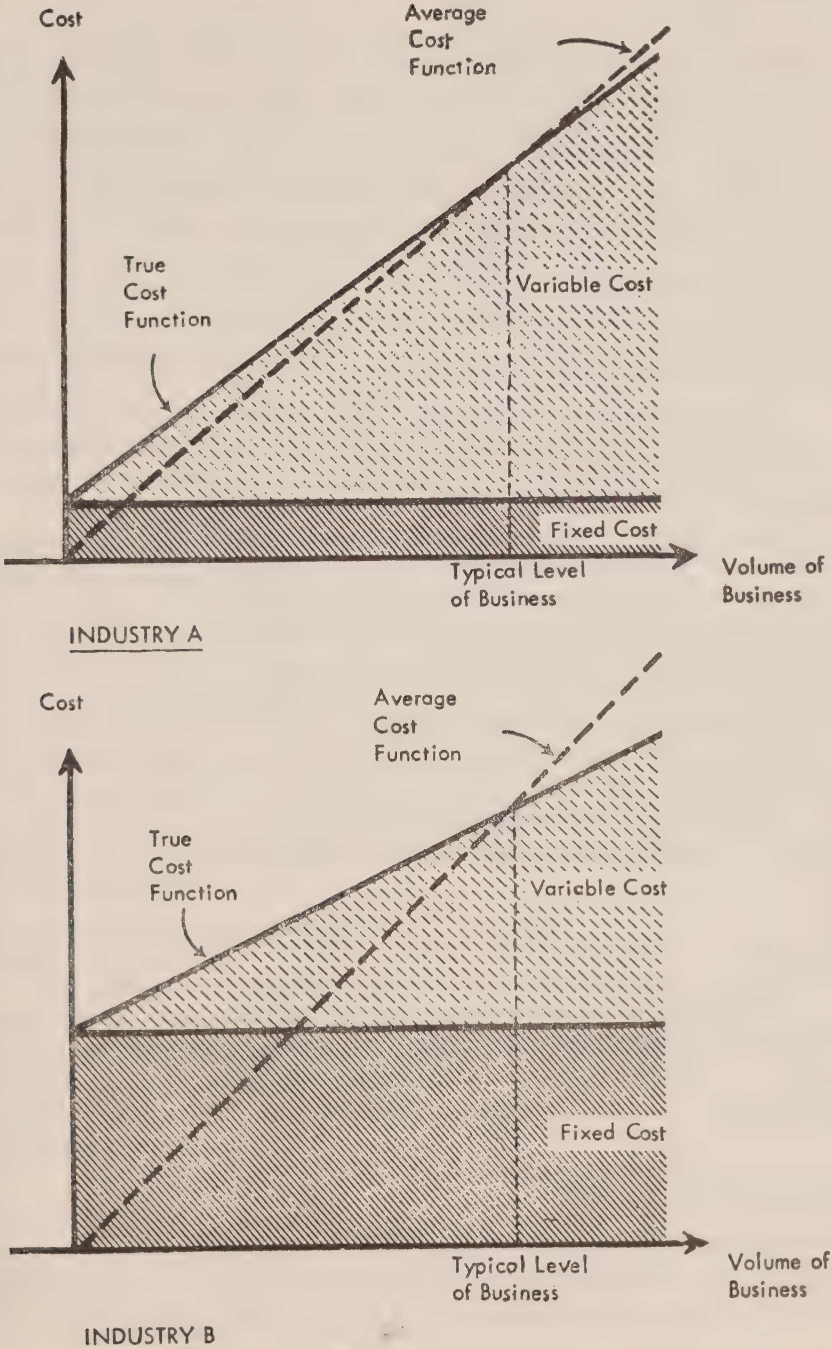


Figure 3

VARYING INDUSTRY COST STRUCTURES



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Fixed Costs

Railroads have large fixed costs for a considerable period of years. Roadbeds, rights-of-way, bridges last for half a century or more. In recent years technological developments have hastened the economic obsolescence of line-haul equipment and terminal facilities. Thus, the modernization drive manifested by dieselization, centralized traffic control, and electronically controlled yards has resulted in the write-off of old and the introduction of new fixed costs; new depreciation bases and new fixed charges on indebtedness. Indeed, there is some evidence, treated later in this report, that technological progress may be in the process of altering conventional concepts of rail cost "fixity," and in its place substituting a type of inverse variability, inasmuch as by contrast with pre-World War II days the rail carriers today handle more traffic with a smaller fixed physical plant.

Investment affords a reasonable measure of the significance of fixed costs, especially in the railroad industry where two-thirds of investment is in road and structures, which are rather permanent, and only one-third in equipment.

For railroads fixed costs loom large because the investment is large relative to output. This relationship is measured by the annual capital turnover; the ratio of gross revenues to capital investment. For railroads the usual ratio has been 1 to 3; that is, there have typically been 3 dollars of invested capital for every dollar of annual receipts. In other words, the average capital turnover required a three year period. In the war years, the ratio was higher than 1 to 3, and in a prior year like 1932, it was as low as 1 to 6. By way of contrast, the steel industry has a capital turnover of once a year or better, while department stores average 3 or 4 times annually. . . .

In brief, it would appear that railroads have the smallest capital turnover in the transportation industry, with airlines enjoying a considerably larger turnover and motor trucks and buses the largest. It follows that such fixed costs as property taxes, fixed rents and interest would loom larger in the railroad cost picture and play a more prominent role in their rate making processes, than would be the case with other agencies of transportation.

Pipeline companies, like the railroads, have large fixed plants, and since their capacity is not fully utilized, a substantial proportion of their expenses are constant in the short run, more so than in any other mode of transportation. Pipeline operating ratios have usually been lower than 50, as compared with the motor carriers, whose operating ratios exceed 90.

Variable Costs

Variable costs may be calculated by comparing total carrier costs incurred when a described service is performed with those incurred in its absence. Examples of such costs are the wages of flight crews, drivers and

trainmen, and fuel. Other costs, such as depreciation of equipment partially accrue with traffic (wear and tear) and partially with other factors (obsolescence, weather). One authority believes that the variable costs of railroads are probably "less than 50 per cent of total costs for the short run."[8] Such is not the case in the trucking industry, where the additional traffic will most likely involve adding an entire transportation unit (tractor, trailer and drivers). Thus the out-of-pocket cost incurred by the addition of another unit is only slightly lower than average cost prior to handling the additional traffic, and is almost equal to average cost after the addition of such traffic. It is commonly agreed that at least 90 per cent of all operating expenses, rents, and taxes of motor freight carriers are variable. The great bulk of all costs are direct, since the narrow gap between revenues and expenses motivates variation in fleet size in response to current levels of capacity and profits. Additional traffic handled therefore raises total cost more or less in proportion to the increase in traffic, and thus the out-of-pocket cost of additional traffic is not substantially less than the full or average cost of handling all traffic.

Air carrier cost characteristics are basically similar to those of motor carriers, although the short run proportion of fixed to total costs is growing as equipment becomes larger. A dozen years ago the standard flight unit was a DC-3 costing $100,000 and costs were fixed for only relatively small increments of passengers. As jet aircraft costing $5,000,000 are introduced, depreciation expenses and ancillary equipment with less variable characteristics loom larger in the total framework of air transport cost. In effect variability is present as before, but only in response to larger increments of traffic. Inland water carrier cost characteristics are substantially similar to those of highway transport. The principal capital outlays by the carriers themselves pertain to barges and towboats, the government providing their navigational channel, and shippers in many instances providing a large part of terminal facilities. . . .

Fixed and Variable Costs in the Railroad Industry

Because of its rate-making implications, assessment of fixed and variable costs is unavoidable in the railroad industry. Attempts at solution have been both complicated and controversial. They involve problems of definition, of concept and of measurement.

Definition

Basic to variability determination is a definition of the time dimension involved.

The distinction between fixed and variable cost cannot be examined therefore without the specification of the time period in which the adjustment

[8] Dudley F. Pegrum, *Public Regulation of Business,* Homewood, Ill., 1959, p. 522.

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to changes in the volume of traffic can be made. Consider, for example, the elimination of rail passenger service from a branch line. The initial effect is merely the reduction in train service and station costs, and only these might be considered as variable. Over a longer period, however, the level of accounts for maintenance of way and structure and maintenance of equipment may be reduced so that part of these costs become variable with changes in the volume of traffic. Over some longer period even general administrative expenses might be reduced as less administrative effort is required for the numerous problems of passenger traffic management.[21]

Consequently, it would appear that an appropriate time-period for measurement of variability would be one in which management has had ample time to adjust cost to typical traffic volume.

Since variable costs in transportation are equivalent to the economic concept of marginal cost, the phrase "long-term marginal cost" is useful in describing cost behavior which comprehends elimination of the inevitable lag between traffic variation and responsive adjustment in operating expense. It follows that any prospective traffic which is offered at rates above the level of long-run marginal cost will reduce the burden of fixed cost on existing traffic.

But how long a time-period is "long-run"? One leading cost analyst, for example, does "not agree that out-of-pocket costs should include 100 per cent of a stated percentage return on investment in equipment and 50 per cent of a stated return on investment in road property. Because of the significant effects of imbalance and seasonality of traffic, he is of the opinion that the railroads have, *during the greater portion of any given year,* considerable excess capacity in equipment and motive power." (Emphasis supplied) Such an analysis is indicative of the absence of agreed definitions. Greater clarity may accrue if out-of-pocket or variable cost was fragmented into the three separate concepts to which it has been applied. These differ from each other primarily in terms of the time dimension that each comprehends, and in the common usage the distinction between them is often overlooked and definitions become hazy. These concepts are (*a*) very short-term cost, which takes into consideration only those expenses directly traceable to the traffic in question, such as added fuel cost; (*b*) short-term marginal cost, which includes both traceable and some other expenses, but allows insufficient time to permit plant to adjust to the changed level of activity, and hence does not reflect the altered operating costs of the changed plant; and (*c*) long-run marginal cost, which not only reflects the traffic impact on *all* categories of cost but also permits reasonable time for plant adjustment. The concept to which reference is made above appears most closely to approach short-term marginal cost. For this reason we believe it to be in-

[21] John R. Meyer, Merton J. Peck, John Stenason and Charles Zwick, *The Economics of Competition in the Transportation Industries,* Cambridge, Mass., 1959, pp. 18-19.

appropriate, since equating out-of-pocket with variable cost has no economic significance unless such out-of-pocket cost contains a fairly conclusive measure of variability. This seems impossible to secure in a relatively short time period. Hence the long-run yardstick, which involves a period long enough to shake out laggard but nonetheless truly variable cost function, is preferable. . . .

Some of the literature treating of marginal cost also contributes to the conceptual difficulties, no doubt due to inadequate definition of terms. For example, in a recent discussion of the subject, it is stated that "In recent years the 'gospel of marginalism' has captured the fancy of many transportation economists. These economists believe railroad rates should be based, largely if not wholly, on the 'marginal' (or additional) cost incurred in moving an added unit of traffic (whether this unit be expressed in hundredweight, tons or carloads)." After thus correctly defining marginal cost, the discussion continues, ". . . any rate equal to marginal cost will contribute nothing to 'the burden' (i.e., fixed costs and those not readily allocated). The 'burden' includes great bundles of *variable* costs which cannot be assigned to specific pieces of traffic."[26]

Everyone may of course define his own terms but "burden" as commonly understood and used is the difference between variable cost and total cost (i.e., between out-of-pocket costs and the total revenue required to meet operating expenses, rents, taxes, and return, as well as deficits from unprofitable services). The difference between these two dimensions is usually regarded as substantially equivalent to fixed or constant cost. Thus in effect, the above text contradicts itself by assuming that fixed cost includes variable cost. Perhaps the apparent supposition that burden includes non-traceable cost explains this paradox, but if so, it begs the question, since the economic objective is to separate long-run variable costs from fixed or non-variable costs.

Figure 4, may assist to clarify this conceptual difficulty. As before, present volume of traffic is represented by T_1. Obviously no one would suggest reducing all rates up to this volume to the variable cost level, since nothing would be left to cover fixed costs, and a *fortiori* net income would long since have disappeared. Additional business (T_1 to T_2) is contemplated. What is the "cost" of the added business? The "average cost" function, which is nothing more or less than an extrapolation of past experience, would yield the result C_3. The true cost function would yield the result C_2. By definition this includes *all* costs, not just those costs which are easily assignable. In the above quotation the "marginal" cost referred to seems to be a function like Figure 4's "Partial-Cost Function," which does *not* include *all* added costs. It would represent easily traceable costs or costs which are affected in the

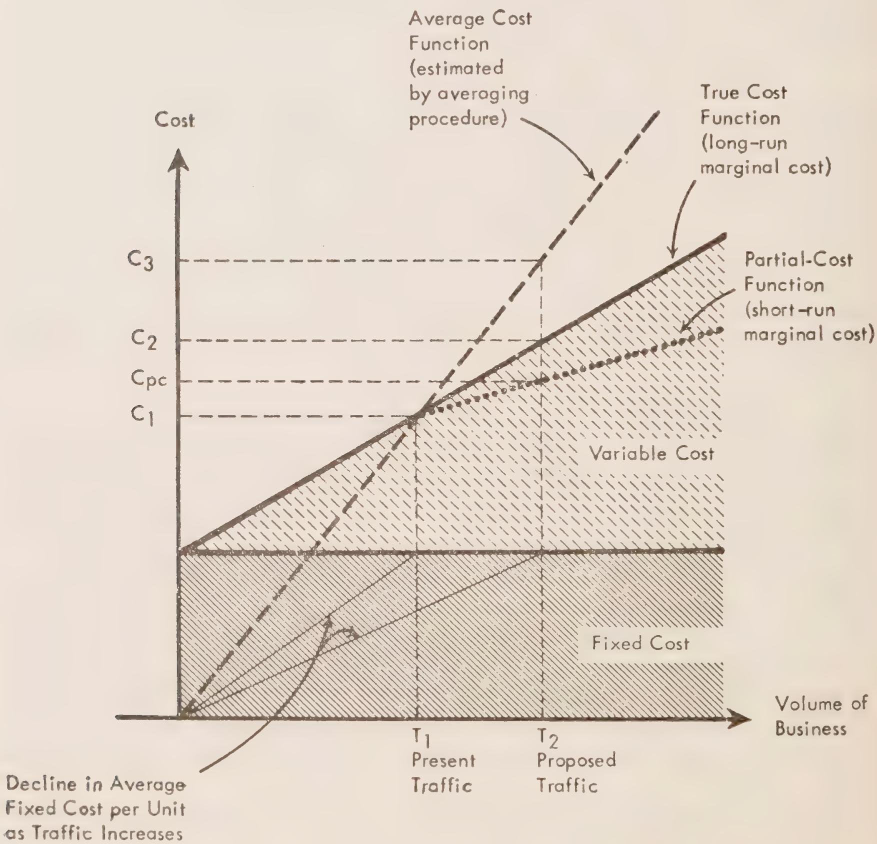
[26] George W. Wilson, "Base Rates on Cost or 'Demand'?", *Railway Age*, September 7, 1959, p. 24.

short-run, i.e. short-term marginal cost, C_{pc}. If the "gospel of marginalism" is to be deplored, a clear distinction must be drawn between the Partial-Cost Function and the True Cost Function. In drawing such a distinction, it must not be overlooked that at volume T_2 (assuming reasonable stability in demand) all traffic carried at volume T_1 remains with the carrier, and presumably continues to pay the same rates as it did before, thus contributing revenues sufficient to cover fixed costs.

Assuming no carrier disposition to grant rate reductions to purely marginal levels for existing traffic sources (and no persuasive reasons have been advanced to indicate that this would be a practical consequence of a marginal pricing policy), all the cost that has to be covered is the *added* cost of volume (T_1 to T_2), which is represented by (C_1 to C_2). This is the true

Figure 4

TRUE AND PARTIAL-COST FUNCTIONS

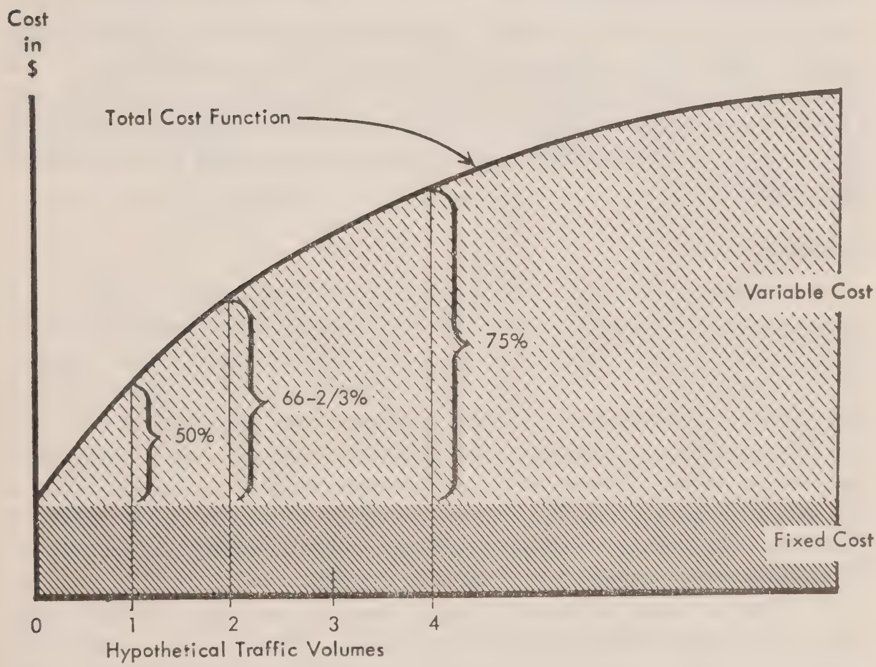


variable cost, i.e., long-term marginal cost. Any rate *above* this cost adds to net income, even though that rate may not approach C_3.

In Figure 4, "fully distributed cost" at present traffic levels is fixed cost plus variable cost; "out-of-pocket cost" is simply variable cost. Hence a change in traffic volume from one level to another does not involve fixed costs, since these will not in any way be altered. The significant point for regulatory agencies and for carriers in considering prospective additional traffic, is that all added costs are represented by the variable or out-of-pocket costs; any rate above this level adds revenue in excess of increased expense. Thus the concept of fully distributed cost has no relevance to pricing added traffic.

Figure 6

VARIABLE COST PORTIONS DIFFER WITH TRAFFIC VOLUME



Section 6

Directly Assignable and Common Costs

Another major problem in transport cost finding relates to the substantial fraction of total cost, which under most conditions cannot be directly assigned to particular types of traffic. This stems from the fact that trans-

portation is essentially a multi-product industry, with several services typically using the same facilities, and with huge expenditures made on behalf of all of them.

Directly Assignable Costs

Directly assignable costs are those which are immediately traceable to particular items of output; in transportation they are said to be costs which can be allocated to particular traffic. They are largely composed of the actual expense involved in moving equipment from point to point, and costs incurred on behalf of specific traffic or traffics. These costs are similar to what the ICC labels "solely related costs" in passenger or freight service, and in connection with rail branch lines whose existence is "solely related" to one particular freight commodity. In truck transportation fuel and driver wages are directly assignable costs: here their identity with variable costs is at once manifest. Similarly, in air and rail transport, plane and engine fuel and crew wages comprise the largest proportion of so-called directly assignable cost. The concept of "above the rail" costs frequently employed in rail passenger curtailment cases, is substantially equivalent to directly assignable cost, and as such falls short of measuring all costs properly associated with the service being analyzed.

Common Costs

Common costs are those incurred by several types of traffic, e.g., in rail by freight and passengers, (or LTL and truckload, in the case of motor freight carriers. Since such costs cannot be allocated, they must be apportioned. For example, if a particular flight carries all types of traffic, or a train carries mail and express as well as passengers, the wage and fuel costs of the flight or of the train movement are largely (but sometimes not exclusively) common to all the types of traffic. These costs may be compared with the cost of a stewardess or food on the plane which would be cost traceable to passengers only, a single traffic component. In other words, costs are common when incurred on behalf of more than one service. . . .

Common costs, while not precisely separable with respect to a product service, may nonetheless be variable with output. Thus, all flying operations and maintenance expenses of a plane carrying mail, express, freight and passengers represent common costs incurred directly on behalf of all four traffic categories. The same is true of a rail car carrying express and mail.

The significant difference between the common cost situation of railroading and those of the other regulated carriers lies in their location. The common costs of railroads are experienced largely within the industry itself. Where more than one carrier is involved, joint facility arrangements apply. By contrast, the common costs typical of other modes occur substantially

outside the transport firm (which is to say, they are borne in the first instance by the government). This should not be allowed to obscure the fact that the measurement of common costs is a significant, and largely unresolved issue for these modes also.

The predominant common cost situation in motor transportation for example, centers about joint use of the highways by both private autos and trucks. Thus highway transportation officials are faced with apportioning not only pavement costs, but also such expense as:

Right of Way Requisition	Snow Removal
Fences	Drawbridge operation
Markers and Signs	Earthwork
Traffic Lights	Guide Line Painting
Dust Palliatives	Sidewalks
Traffic Counts	Soiling, Seeding, Sodding

among the various categories of vehicular traffic.

Enormous efforts and expense have gone into attempts to resolve the common cost question in motor transportation. These involve both empirical engineering tests and abstract mathematical analyses. The more sophisticated of such studies have used the "incremental" method, which involves isolation of highway costs incurred for common use and their separation from costs incurred especially for particular groups of highway users, among which the vehicles commonly used by regulated motor carriers loom large. The practical questions are, by analogy, much the same as in the railroad industry. However, the promise of solution in the incremental method is more potential than actual; before precision can be obtained, large gaps in current knowledge remain to be filled. . . .

Difficulties attaching to measurement of such costs have not of course, precluded attempts at cost recovery through user charges for highway and airport facilities in which governmental entities have substantial investments. A multiplicity of fees and taxes now imposed for this purpose on motor and air carriers are reflected in their operating expenses. However, these fees and taxes are quite inadequate measure of such costs. This is not to say that the user charges now imposed are, in the aggregate or in any specific case, too high or too low. The point of significance here is simply that no one really knows. The great disparity in such fees and taxes among the jurisdictions which levy them would tend to indicate that relatively little progress has been made in relating them with precision to the costs they are ostensibly designed to cover. . . .

It is thus apparent that common costs pose difficult administrative and technical problems in cost ascertainment. At this writing much remains to be done with this particular matter; it cannot be allowed to remain in limbo if public policy requires an increased measure of precision in transport costing.

Joint Costs

Common costs not traceable to individual products are, in the economic sense, further classifiable into joint and alternative product costs. True jointness exists only when the production of one commodity (e.g. butter) necessarily results in the production of another (e.g. buttermilk). Therefore, an increase in the production of one commodity necessarily increases the output of the other. If, however, the output of butter resulted in a decrease in the output of buttermilk, then the products would be alternative. An example of the latter in transportation would result from relocating an aircraft bulkhead to enlarge cargo capacity, thereby decreasing the passenger cabin. An increase in time of railroad top management devoted to freight service rather than passengers is likewise a case of alternative product cost.

Illustrative of joint costs in transportation is the return movement of line-haul equipment, for supply of return capacity is totally dependent upon outward supply. An increased demand for service between points X and Y (unaccompanied by service demands between Y and X) will have to be met by a rate covering all costs encountered in the backhaul or empty return. Return traffic may be encouraged at rates approaching out-of-pocket cost for the backhaul, and revenues received from such traffic apply against entire round-trip cost. However, if low rates on the backhaul stimulate sufficient traffic to warrant increased capacity or an increase in service from Y to X then the rates are uneconomic for the added capacity. The return capacity that was a "by-product" now becomes a "primary product" and the outward mileage is the "by-product". Thus the established rates are inadequate since total revenues are now insufficient to cover out-of-pocket round trip costs.

Larger carriers attempt to minimize their joint costs through operation of "cornered trade," in other words, equipment moving from A to B need not necessarily return empty directly from B to A, but instead may go under load from B to C to D to A, thus reducing the joint cost impact.

Differences between Constant and Joint Costs

The characteristic shared by both constant and joint cost is that neither is assignable to individual units of traffic. On the other hand unit joint costs are unaffected by the extent of plant utilization, whereas constant costs are minimized as a carrier reaches the volume of output (transportation service) at which maximum utilization is obtained. At such a traffic level, the law of decreasing costs no longer applies and all costs become variable with output. By contrast, the return movement of transportation equipment is as much a joint cost when a carrier is operating at capacity as it was at a lesser traffic volume.

A Note on Multiple Regression Analysis and A Note on Tests of Significance

by

WM. C. HOOD

TORONTO 1961

A Note on Multiple Regression Analysis

In this note, the main principles of multiple regression analysis are explained simply. We start first with simple regression analysis, move on to multiple analysis, then offer an interpretation of results and compare regression methods of distributing costs with methods.

Simple Regression Methods

Regression analysis is concerned with measuring the degree of relationship between or among variables. It derives its name from an early application to the study of the relation between heights of sons and heights of fathers to determine whether heights of sons "regress" to heights of fathers. The name "regression" has continued to be used to describe the method whatever the application.

Let us suppose that because of our general knowledge of railroad operations, we believe (or are willing to propose as an hypothesis to be tested) that a particular category of railway expenses (E) is related

(a) principally to traffic (T)

and also to (b) unspecified variables (U)

which collectively may be important at times though not on the average, but which individually are presumed to have no significant effect, ever.

Let us suppose further that we have measurements on this expense item and on traffic for each division of the railroad and that we plot the pairs of observations pertaining to each division as points on a diagram such as Diagram I.

If the scatter of points gives an impression of a straight-line relationship between E and T and if this accords with our preconceived ideas we will postulate that the relation between E and T is a straight line and our problem will then be to find the line which in some sense best fits the divisional observations. Clearly we do not expect the line of relationship to pass through every point, for that would imply that the unspecified variables U have no effect ever, and not merely no effect on the average.

We think of the line as being described by the equation

$$E = a + bT$$

where, as in Diagram II, a is the amount of expense incurred irrespective of the amount of traffic and b is the slope of the line, that is the increase in expense per unit increase in traffic. It might be thought desirable to choose

a and b so as to minimize the average values (over all divisions or observations) of the deviations of the points from the line. As a matter of fact we do rather better than that; we choose a method that makes this average value zero and which minimizes the average of the squared values of the deviations. (Squaring the deviations gives special emphasis to the large deviations and avoids the nuisance that some deviations are positive and others negative.)

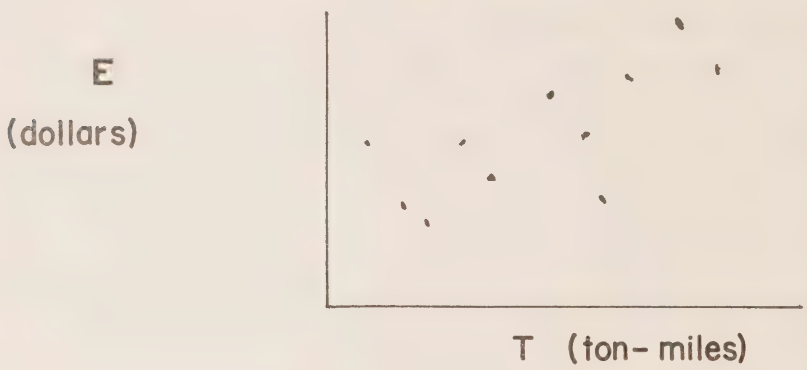


DIAGRAM I

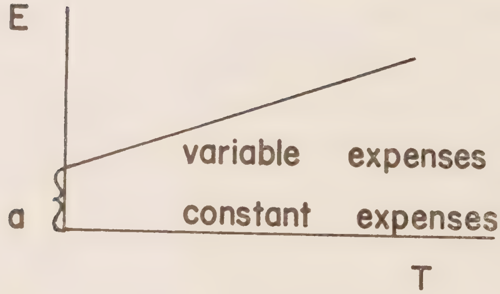


DIAGRAM II

Simple regression analysis, using straight lines, then involves choosing the constants a and b of the line of relationship so that the average of the squared values of the vertical deviations of the observations from the line is a minimum, *i.e.,* so that

$$\frac{\underset{\text{all d}}{\text{Sum over}} \left\{ E_d - (a + bT_d) \right\}^2}{\text{Number of divisions}}$$

is a minimum.

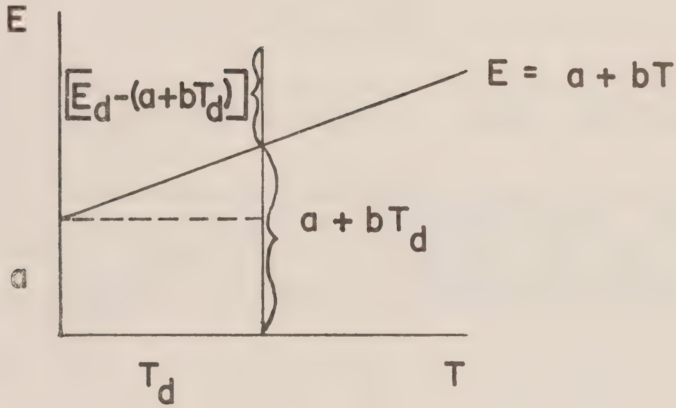


DIAGRAM III

Multiple Regression

We have considered the case in which only one specific variable was used in explaining expenses, multiple regression involves the explicit use of two or more variables to explain expenses.

Let us suppose that our general knowledge of railroad operations would lead us to believe that expenses (E) are related

(a) principally, though in different degree to passenger traffic P and freight traffic F, and

(b) to unspecified variables U.

Let us suppose further that we have measurements on this expense item and on passenger traffic and freight traffic for each division of the

railroad and thus we plot the two graphs shown in Diagram IV where each point in a graph pertains to a division.

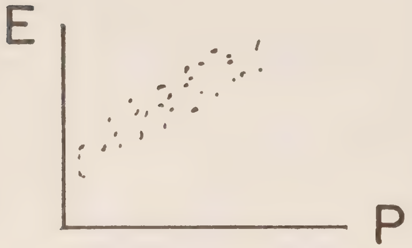


DIAGRAM IV

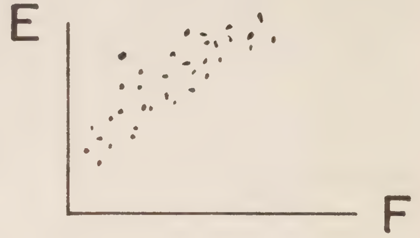


DIAGRAM IV

If these two scatters of points each give an impression of straight-line relationships between expenses and the component, passenger or freight, of traffic and if these impressions accord with our preconceived ideas we will postulate that the relation among E, P and F is a straight line of the form

$$E = a + b_P P + b_F F$$

where a, as before, is the amount of expense incurred irrespective of the amount of traffic, b_P is the increase in expense per unit increase in passenger traffic for any fixed level of freight traffic, and b_F is the increase in expense per unit increase in freight traffic for any fixed level of passenger traffic. Geometrically, the equation represents a plane, instead of a line as before, and multiple regression analysis involves the choice of a, b_P and b_F on the basis of the divisional observations in such a way as to minimize the average, over all divisions, of the squared deviations of expenses as observed from expenses as calculated from the equation, that is so as to minimize

$$\frac{\underset{\text{all d of}}{\text{Sum over}} \left\{E_d - (a + b_P P_d + b_F F_d)\right\}^2}{\text{Number of divisions}}$$

As in the case of simple regression, the choice of constants will always be such that the average of the calculated deviations will be zero.

Interpretation

It is to be noted the method of regression analysis divides a particular category of expense into that portion which is constant and that portion which is variable and that further it allocates the variable cost among the several variables which give rise to its variation. Thus, for example, a total expense ΣE_d, considered over all divisions, which let us say number N, is broken up as follows:

Na	— constant portion
$b_P\Sigma P_d$	— variable portion attributable to passenger traffic
$b_F\Sigma F_d$	— variable portion attributable to freight traffic
ΣE_d	— total expense for all divisions

This method of allocating expense to the constant and variable categories and among factors contributing to variation may be contrasted with two alternative schemes.

1. Consider first a scheme to be called *prorating*. It may be thought that the category of expense E under consideration is wholly variable and to be attributed to passenger traffic and to freight traffic. Suppose that the data on these variables are expressed in passenger car-miles and gross ton-miles respectively. It is then necessary first to convert these measures to a common unit. If the expense item under consideration is for example, station expenses, it may be thought that station expenses depend on hours taken to process the paper (waybills, tickets, etc.) governing passenger and freight traffic and that these time factors depend on the respective volumes of traffic. It is then necessary to find the factors—here called H_P and H_F—by which to convert car-miles and ton-miles to common units. Having determined these, the proportions of hours devoted to passenger and freight traffic respectively are calculated and applied to the total of expenses in the category under consideration to determine the distribution of expenses as between passenger and freight traffic. The division may be expressed as follows, using notation already introduced:

$$\left(\frac{H_P}{H_P\Sigma P_d + H_F\Sigma F_d}\,E\right)\Sigma P_d \text{ — variable portion attributable to passenger traffic}$$

$$\left(\frac{H_F}{H_P\Sigma P_d + H_r\Sigma F_d}\,E\right)\Sigma F_d \text{ — variable portion attributable to freight traffic}$$

$$\Sigma E_d \text{ — Total expenses}$$

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Comparing the items in brackets with b_P and b_F in the regression analysis, it is readily seen that the prorating method here described is complicated in that (a) it has to adduce hypotheses not necessary in regression analysis in order to convert explaining variables to common units, and (b) there is a tying together of the two terms in brackets imposed by the common terms in each, which is not featured in the same way in regression analysis.

2. In the example just given we argued as though all expenses in the given category were thought to be variable. If they are not all thought to be variable, the constant portion must be separated and the prorating scheme applied only to the remaining variable portion. A common method for effecting this separation employed widely in ICC cost studies, for example, is to perform a simple regression of *total* operating expenses in all categories against a traffic variable covering all operations of the railroad and determine the per cent of all expenses variable (as we did in the first part of this paper) and apply this percentage to *all* categories of expense. The very high degree of approximation involved in this procedure need not be stressed.

Conclusion

It would be wrong to leave an impression that the use of multiple regression techniques reduces railway costing to an artless routine. There is a good deal of art or judgment involved in the use of these techniques. For example, the choice of which variables to settle upon finally as determinants of a particular item of expense involves art, though there are several widely accepted rules, with firm foundations in the theory of the subject, to guide one. No doubt these rules will be further developed in the years to come.

The use of multiple regression techniques represents a breakthrough in railway costing permitting some escape from the particularly restrictive assumptions involved in the variations of prorating now in such wide-spread use. The adaptation of this long established statistical procedure to problems of cost accounting may be expected to show pronounced development in the next few years.

A Note on Tests of Significance of the Coefficients of the Independent Variables in Statistical Cost Equations

It is the purpose of this memorandum to give a brief account of the statistical theory underlying tests of the significance of the coefficients of the independent variables in least squares regressions.

In particular, the railways have used, for example, equations of the form

$$E = a + b_P P + b_F F \tag{1}$$

where E is the total expense of a specified category, measured in dollars,

a is a constant measured in dollars

P and F are independent variables, measuring passenger traffic and freight traffic respectively in natural units such as ton-miles;

b_P and b_F are constant coefficients, measured in dollars per unit of passenger traffic and dollars per unit of freight traffic respectively.

So-called "t-tests" of significance of the coefficients b_P and b_F have been applied as one indication of the acceptability of a statistical cost equation. We shall explain (a) what a t-test is; (b) what is the difference between a "one-tailed" and "two-tailed" test; and (c) the reasons for the appropriateness of the "one-tailed" tests in the tests of the coefficients in the equations used by the Canadian Pacific and Canadian National Railways.

What is a "t-test"

Using the illustration given above, the theory underlying the application of least squares regression to the explanation of the generation of expense E is that in each division of the railway in the three-year period for which the observations were taken, the expense E_d is to be explained by the sum of the constant a and the linear combination of traffic variables $b_P P_d + b_F F_d$ *plus* a random factor, U_d, standing for unspecified factors which collectively may be important at times though not on the average. It is an integral part of the theory that this random factor U_d is prescribed to be characterized, in each division, by the *same* normal probability distribution, having mean equal to zero and some particular finite variance. The data for each division imply a particular value of the random variable U_d, the value that is handed to us by nature as it were, making a random selection for us from this normal

distribution. According to this view, the amount of expense in division d may be expressed as

$$E_d = a + b_P P_d + b_F F_d + U_d \tag{2}$$

where the subscript d refers to the particular division d.

The important point to note in the present context is that, regarding P_d and F_d as fixed (non-random) variables, E_d, the observation of the expense in division d is itself a random variable because of its dependence upon the random variable U_d. Moreover, since the estimates b'_P and b'_F of the coefficients b_P and b_F depend upon the observations of the variables E_d in all divisions, these estimates must also be regarded as random variables.

It is a comparatively simple matter for the theoretical statistician to prove that if the random variables U_d have a common normal probability distribution with mean zero and finite variance, the random variables b'_P and b'_F will be characterized by the probability distribution widely known as the "t" distribution. It is because the "t" distribution is used in testing the significance of the coefficients b_P and b_F that these tests are referred to as t-tests.

The "t-test" in relation to the coefficient b_P, for example, is an evaluation of the hypothesis that the coefficient b_P is in fact zero. In making the evaluation of this hypothesis the knowledge of the estimate b'_P and of its distribution—the t distribution—is used. Roughly put, the problem is to decide whether the observed value of b'_P can be held to be consistent with the hypothesis that $b_P = 0$ given the probability distribution of b'_P.

One-tailed and Two-tailed Tests

In constructing a test of the hypothesis that b_P is zero we have to

1. specify the alternative hypothesis or hypotheses that we are prepared to accept if we do not accept the hypothesis that $b_P = 0$;
2. divide the possible values of the estimate b'_P into two groups: the values which would warrant acceptance of the hypothesis that $b_P = 0$ and the values which would warrant the rejection of this hypothesis in favour of the alternative or alternatives.

It is not possible to do step 2. until after step 1. has been taken.

The alternative hypotheses mentioned in step 1. commonly take *one* of three forms:

A. $b_P \neq 0$

B. $b_P > 0$

C. $b_P < 0$

It will be noted that in the first set of alternative hypotheses the admissible alternatives include both values of b_P that are greater than zero and values that are less than zero. The test of the hypothesis $b_P=0$ against this set of alternatives is known as a "two-sided" or "two-tailed" test. In the sets of alternatives B. and C. the admissible alternatives are either greater than zero (case B.) or less than zero (case C.) but not both. The test of the hypothesis $b_P=0$ against alternatives B. is known as a "one-sided" or "one-tailed" test. Similarly the test of the hypothesis $b_P=0$ against alternatives C. is also known as a "one-sided" or "one-tailed" test. We shall argue below that in the railways' cost analysis alternatives B. are the relevant ones. First however let us examine the nature of hypothesis testing further.

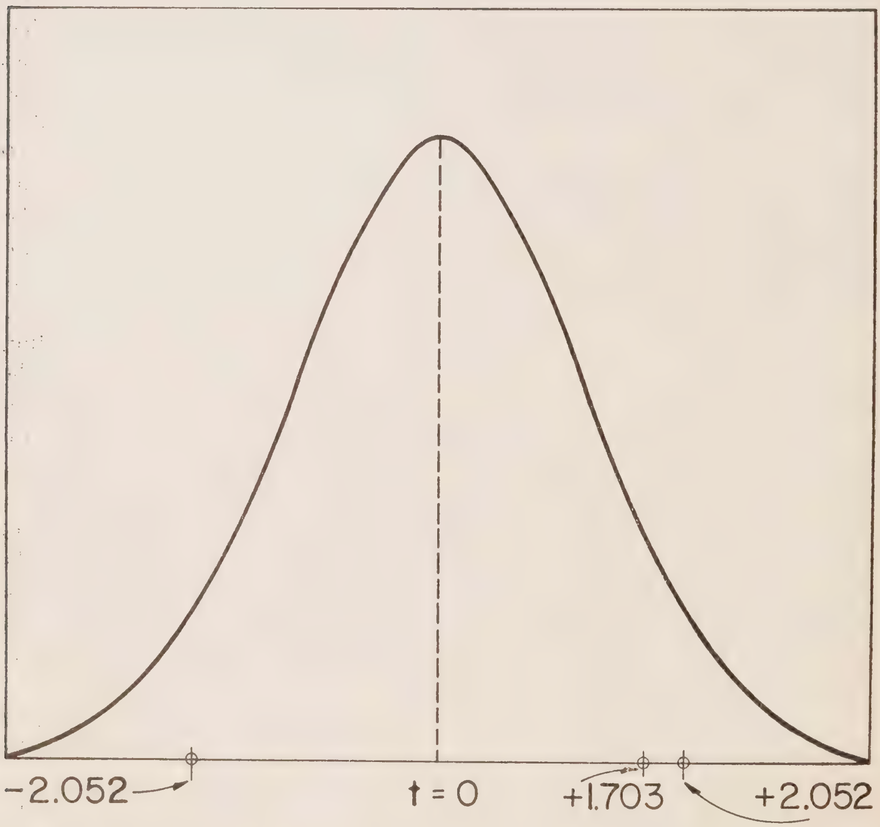
In testing the hypothesis $b_P=0$ against a specified set of alternatives, it has to be recognized that we cannot make our decision with absolute certainty. This is in the nature of the case. We must base our decision on the value of the estimate b'_P that we observe, and we have to recognize that b'_P is a random variable which can occasionally assume extreme values. In fact we must expect from time to time to make each of two kinds of error. The first type of error is that of not accepting the hypothesis $b_P=0$ when it is true. The second type of error is that of accepting the hypothesis $b_P=0$ when it is false. The commonly used strategy of hypothesis testing is to fix the probability of a Type I error at some specified level and make the probability of a Type II error as small as possible. Unfortunately we cannot arbitrarily fix the probabilities of *both* types of error; we have to trade one off against the other.

The assigned probability of a Type I error, that is of not accepting the hypothesis $b_P=0$ when it is true is known as the significance level of the test. This probability is often assigned a value of 1 per cent or 2.5 per cent or 5 per cent or sometimes higher values up to 10 per cent depending upon circumstances. The probability of a Type II error is known as the operating characteristic of the test; its complement, that is one minus the probability of a Type II error, is called the *power* of the test. It is the probability of rejecting the hypothesis $b_P=0$ when it is false. We may sum up the strategy of hypothesis testing then, by saying that after we have decided upon the set of alternative hypotheses, we fix the significance level of the test and then devise the test procedure so as to maximize the power of the test to reject the hypothesis $b_P=0$ when it is false.

To fix the significance level of the test permits the delineation of a series of ranges of values for the test statistic b'_P such that the probability that the statistic as calculated will fall within these ranges, *if* $b_P=0$, is not greater than the significance level of the test. To maximize the power of the test is to choose from the series of ranges that are consistent with the significance level of the test that one range which maximizes the probability of rejecting the hypothesis $b_P=0$ when it is false.

The power of the test can be calculated with respect to each alternative in the admissible set of alternatives. It is the probability that the test statistic, b'_P will fall within the range leading to rejection of the hypothesis $b_P=0$, calculated on the assumption that this particular alternative is true. We may denote the power of the test then with respect to each alternative hypothesis in the admissible set. It is not always possible to maximize the power of the test with respect to each alternative in the admissible set; sometimes we have to be content with achieving a maximum average power over all alternatives.

In fact, since the estimate b'_P divided by its estimated standard deviation is the standardized statistic "t", ranges of b'_P can readily be translated into ranges of "t". In the diagram we have sketched the probability distribution of t. The distribution we have drawn is based on the assumption that in fact $b_P=0$.



On this assumption it can be shown that values of t greater than 2.052 or less than —2.052 will occur with probability of 5 per cent (when the

number of degrees of freedom, *i.e.*, the number of observations less than the number of constants determined by the regression equation is 27). It can further be shown that when testing against the alternatives

$$b_P \neq 0$$

this range of t values, *i.e.*, $t > 2.052$ and $t < -2.052$ gives the highest *average* power of the test, considering all alternatives in the set $b_P \neq 0$.

Still referring to the diagram, drawn upon the assumption that $b_P = 0$, it can be shown that values of t greater than 1.703 will occur with probability of 5 per cent (when the number of degrees of freedom is 27) and that when testing against the alternatives

$$b_P > 0$$

this range of t values will give the highest power of the test in respect of *each* alternative in the set $b_P > 0$.

It is very important to note in the present context, and with special reference to the problem to be taken up in the next section of this memorandum, that for any tests of specified significance level, say 5 per cent, the power of the test in respect of alternatives on one side of zero, is higher in the case of the appropriate one-sided test than in the case of the two-sided. Let us express this proposition in yet another way. Consider the hypotheses in the set $b_P > 0$. We may test the hypothesis $b_P = 0$ against these alternatives alone or, using a two-sided test, in conjunction with the alternatives $b_P < 0$. If we use the same significance level in either procedure, then if in fact $b_P > 0$, the probability of rejecting the hypothesis that $b_P = 0$ is greater when we use the one-sided test than when we use the two-sided test. We cannot prove this proposition here, but we would draw the attention of the reader to the graph of the power functions of the two-sided and one-sided t-test procedures having the same significance level that is shown on page 263 of A. M. Mood's *Introduction to the Theory of Statistics.* This graph illustrates the proposition. The adjoining discussion in the text cited, analyzes the proposition.

The Appropriateness of the One-tailed Tests of the Coefficients of the Railway Cost Regressions

When we make a two-tailed or two-sided test, if we reject the hypo thesis that $b_P = 0$, we accept the alternative that b_P is either greater than or less than zero and we make no distinction between these possibilities. If in fact we have no reason to make any distinction between these possibilities, then this is a perfectly sensible and proper procedure.

It so happens, however, that in the case of the railway cost regressions we would in no instance be prepared to countenance the view that the expense might vary *inversely* with the independent variable. In every instance we believe that the expense varies either *directly* or not at all with the independent variable. Since this is the belief and since there is no debate on this point whatever, it makes no sense, in constructing our test procedures, to allow as an admissible alternative hypothesis the possibility that expense might vary inversely with the independent variables. Since there is agreement that the relationship between expense and the independent variable is in every case either non-existent or direct it follows that we should allow as admissible alternative hypotheses only the set

$$b_P > 0,$$

to refer to our specific example for the sake of concreteness.

What are the consequences of this practice?

In the first place we make our test procedure consistent with the *a priori* information we have. In the second place, as we argued in the preceding section of this memorandum, we maximize the probability of rejecting the hypothesis of no relationship between the traffic variable (or independent variable) and expense when in fact there is a direct relationship. That is to say we maximize the power of the test in respect of the alternatives $b_P>0$. Finally, it is to be noted that even though it is entirely possible that specific samples will yield estimates b'_P of b_P that are negative we do *not* reject the hypothesis that $b_P=0$ when we obtain such estimates. Indeed all negative values of the test statistic (as well as positive values up to and including the value corresponding with a value of $t=1.703$—for tests with significance level of 5 per cent and 27 degrees of freedom) lead to the acceptance of the hypothesis of zero relationship, *i.e.*, $b_P=0$.

M. G. Kendall in volume 2 of his *The Advanced Theory of Statistics* in concluding his chapter 26 on the general theory of significance tests writes (p. 303) as follows:

> "It is difficult to reduce rather vague prior knowledge of a parameter to numerical form, and hence to extend our theory with great precision to cover these cases; but in practice it is desirable to consider, before adopting a test, whether any prior knowledge is available, or whether our interests centre on particular parts of the range. If they do, we may consider the behaviour of power functions of the possible tests at our disposal and examine which is the more powerful test *in the particular part of the range which interests us most.* The mere fact that the theory developed in this and the succeeding chapter makes no

assumptions about the prior probabilities of admissible alternatives does not mean that we should be acting sensibly in ignoring any prior information which may be at hand when applying the theory, or that we need feel compelled to apply tests with optimum properties in regions where we know the unknown parameter-values will not fall."

The Problem of Grain Costing

by

D. H. Hay

Ottawa 1961

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Chapter 1

Introduction

The report contained in the following chapters attempts to meet several objectives simultaneously. In the first place, the author was directed by the Commission to examine the presentations of the various expert witnesses who appeared before the Commission to testify upon the costs of moving grain by rail from the Prairie Provinces to the export ports (the so-called Crowsnest traffic); and, following that examination, to report to the Commission his views upon the acceptability of the various conflicting views on the amount of these costs. In the second place, he was directed to pursue a course of independent study, drawing upon the resources made available by the various witnesses, to assess the art of railway costing, so far as this could be done within the limits of the information available to the Commission, and to refine the cost estimates where possible. This report embodies the results of such an examination and investigation.

While the objects of this report are, at least in concept, simple, the audiences to which it was to be aimed form a disparate group. Those members of the Commission who may not have been expert in costing techniques before their sessions began, underwent an intensive course of education during their meetings. Others who may read this report will also be experts in costing techniques. To these, some portions of this report may seem an excessively simple presentation. However, the author was instructed to prepare a document which, as far as possible, would enable members of the public, who have not been trained in costing procedures, to understand the arguments which were presented to the Commission and which may be presented in future hearings of other bodies. It is probably impossible to speak to these two groups, in one volume, to the complete satisfaction of both. It is to be hoped that the danger of satisfying neither group has been reasonably avoided.

Even those witnesses who were in partial disagreement with their conclusions paid tribute to the work which was presented by the cost analysts of the Canadian Pacific Railway and the Canadian National Railways. It was generally agreed that their extensive use of multiple correlation analysis in official proceedings was a valuable contribution to the art of railway costing.

R. L. Banks and Associates and W. B. Saunders and Associates each presented criticisms of the railway cost estimates. The value of their contributions will speedily become apparent to the reader of this report. In this con-

nection, tribute should be paid to the officials of the two railways who freely provided material to these consultants and to the Commission staff in order that criticisms could be founded in fact.

The criticisms of the railway methods were mainly related to the presentation of the Canadian Pacific Railway. The same procedure has been followed here. For the most part, the two railways used parallel methods of estimation. To the extent that they did so, criticisms of the Canadian Pacific methods obviously apply equally to the Canadian National Railway methods. The most important differences have been noted in this report. Where it was possible to do so, preferences between alternate methods were indicated.

A cost analysis of the type discussed in these chapters deals with a great many items. It is obviously impossible to discuss each of these at great length and still preserve a volume of manageable proportions. The principle of selection has been to discuss at greatest length those parts of the cost study which have generated the most serious differences of opinion among the consultants and those parts which were of greatest importance in the final results of the cost study.

The author wishes to thank Professor F. W. Anderson, Director of Research of the Commission, Professor D. E. Armstrong of McGill University, and Professor Wm. C. Hood of the University of Toronto. Each has read this report in draft and has offered helpful suggestions. The responsibility for errors and omissions remains solely that of the author. Thanks are also due to each of the other members of the Commission staff. All have provided assistance. In particular, thanks are due to Mrs. F. Bériault who acted as secretary to the author and Miss V. Young who performed many tedious statistical calculations.

Finally, the author must thank the members of the Commission. The conclusions presented here, and many of the comments, were presented to the Commission first during some of their private meetings. The Commissioners discussed these with the author with unfailing patience and consideration. It is hoped that the contents of this report aided the Commission to reach its conclusions. It is certain that constructive criticism by the Commissioners improved the report.

Chapter 2

The Problem of Railway Costing

The total cost of operating a railway can be found without too much difficulty. One need merely keep track of the expenditures for a given period and add to these a suitable allowance for depreciation. In an era when the railways had a significant degree of monopoly on all or most of the traffic handled, they hardly needed to go beyond the measurement of total cost. If total revenues did not seem likely to carry the total cost of the railway, the entire rate level could be raised to do so. Under competitive conditions, however, it is necessary to know the cost of transporting specific commodities between specific points. If alternative means of transportation can offer a rate below the cost of that movement by rail, a railway which does not know its specific costs may attempt to compete; thereby it will, in effect, pay for the opportunity to carry the goods. The final result of such a pricing policy is, of course, bankruptcy. On the other hand, if the railway is too cautious, it may set a rate which is well above the cost but at which the traffic will move by the competitive means. In this case, the railway will be turning away a profit.

Regulatory agencies also have need of specific cost information. If it is claimed that one of a pair of rates is discriminatory, a showing of different costs may be included in the defence of the rates. Also, specific cost data is necessary if the regulatory authority is to guard against "unfair" competition. In this regard, the theory is that, since railways tend to be large organizations, they will tend to have relatively large financial resources even if they operate at a small profit (as measured against either volume of traffic or investment). If such organizations have a large number of small, but lower cost, firms arrayed against them as competitors, it is possible for them to charge rates at less than their competitors' lower costs. When this has continued for a sufficient length of time, the competitor will be driven out of business. If this happens, the railway will then be able to revert to higher, and profitable, rates on traffic which, in the absence of this tactic, it would not have had. Since the effect on the public is to substitute a carrier with higher costs for one with lower, regulatory bodies are on guard against this type of "unfair" competition. They, therefore, insist that rates lowered to meet competitive costs must cover the cost to the railway of carrying the traffic. It is worth noting that if the competitive mode is an industry which can easily be entered, as is the case with trucking, "unfair" competition is unlikely to succeed and an enlightened management would not be likely to attempt it.

Further, if the two or more carriers are of approximately equal financial strength, the competition between them may become "ruinous competition". The result may be financial failure for all and, at least for a time, there may be no carrier able to serve the public. Even if no competitor dominates the transportation field a regulatory body will wish to guard against unduly low rates of this kind.

In the following pages, some of the problems of estimating transport costs will be examined. This chapter introduces the subject by inquiring, in a general way, into the nature and behaviour of costs. Various definitions will be introduced by means of examples.

The simplest kind of business consists of a single person who buys a single product from a supplier and in turn sells it to his customers. Let us suppose that the owner of this business carries it on from his own home—to which no alterations are required because of his business activity. Further, let us suppose that he purchases his stock on consignment, paying for it only as it is sold, and that he must pay the same price whatever the quantity of the goods which he buys. Under these conditions, in any given period of time, his cash outlay will be the cost per unit which he sells multiplied by the number of units sold. Graphically, this can be illustrated as in Figure 1. Here, the vertical axis represents the total cost and the horizontal axis the quantity purchased by our businessman. As the quantity bought increases, the cost increases. In the hypothetical example pictured in Figure 1, each unit is represented as costing seventy-five cents. It has also been assumed that small fractions of a unit can be sold. This is the average cost and is constant, no matter what quantity is bought and sold by our businessman. Economists also discuss the *marginal cost*. This is the cost of

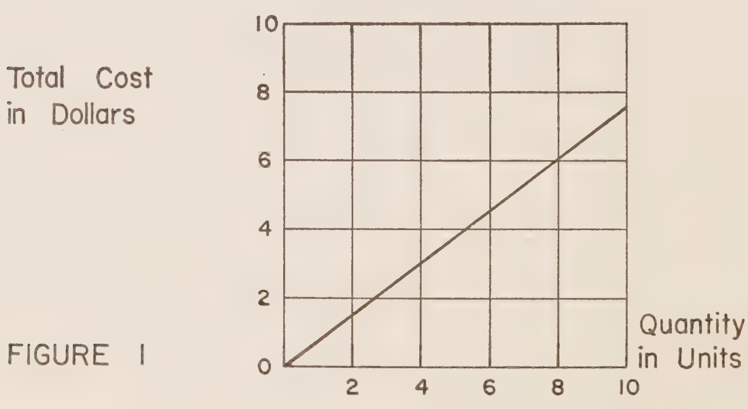

FIGURE 1

an additional unit added to any existing level of production or, in this case purchase and re-sale. In our example, the marginal cost will also be seventy-five cents. Graphically, the average and marginal costs of our hypothetical business are shown in Figures 2 and 3.

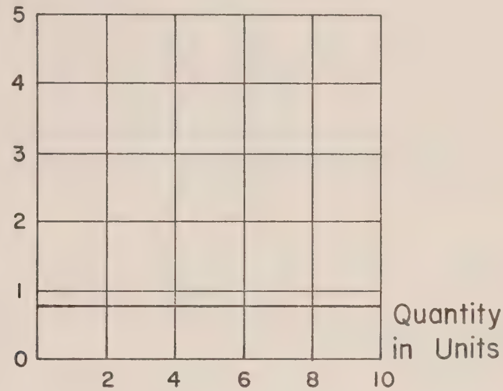

FIGURE 2

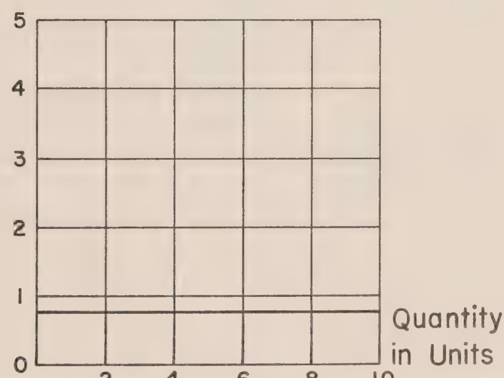

FIGURE 3

Costs of Hypothetical Single Product Business

In the example we have discussed, the cost varies with the output and disappears when there is no output. Assume, now, that the municipality in which this business is carried on passes a by-law requiring the payment of a business tax of one dollar. Then this sum of one dollar would be a cost to the business which could only be escaped by going out of business. Even if in fact nothing was sold, the business tax would have to be paid. In addition, no matter how much was sold, this part of the cost would remain fixed at one

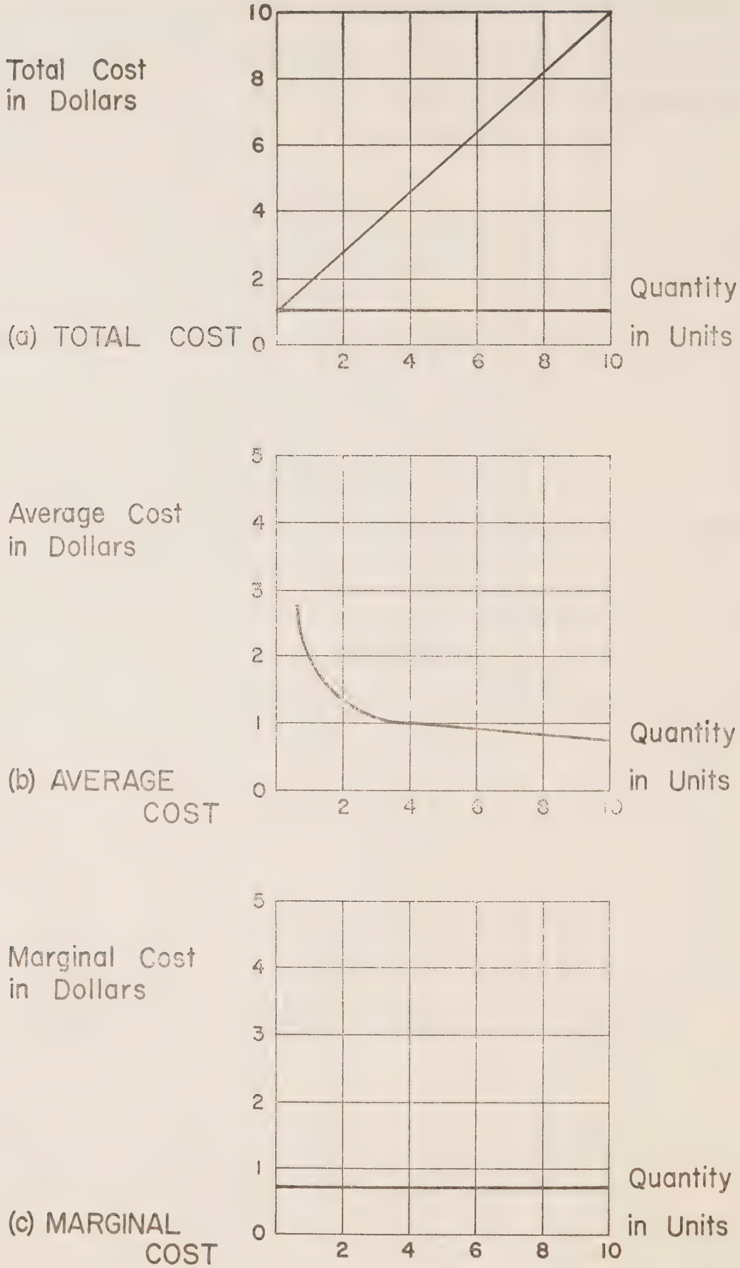

FIGURE 4: Cost Curves of Hypothetical Single Product Firm

dollar. This is an example of a fixed cost. Graphically, the total cost of our hypothetical business would now be as shown in Figure 4*a* and the average and marginal costs would be as shown in Figures 4*b* and 4*c* respectively.

The total cost shown in Figure 4*a* differs from that shown in Figure 1 only in that, at each level, the cost is one dollar higher. The average cost graph of Figure 4*b*, however, shows no resemblance to that of Figure 2. Instead of a horizontal line there is now a curve downwards to the right. At each increased number of units the average cost approaches more closely to the seventy-five cent average cost of Figure 2, for the fixed cost of one dollar is divided by the increasing number of units. The marginal cost of Figure 4*c* is identical with that of Figure 3 for the addition of the one dollar of fixed cost does not change the cost of an additional unit of output at any given level.

As yet, we have made no provision for an income for our businessman. It is to be expected that he would require an income if he intended to pursue the business—although this is not strictly necessary, there may be men of wealth who would engage in a business merely in order to remain busy. The level of income demanded will usually be set by the alternative opportunities available. If our businessman can find other work which pays more he will tend to take it. When he has evaluated the alternative opportunities and taken account of any non-monetary reasons he may have to remain in this business, he will demand a certain income from it. This amount will be a part of the fixed cost of the business.

If the supplier now changed his conditions so that our businessman had to pay for his supplies upon delivery to him rather than upon their sale, it would be necessary for the businessman to invest funds in working capital. But alternative investment possibilities will be open to him, he will therefore demand a return on this investment equal to that which he could obtain from an alternative investment of equal risk. This return is known to economists as the *normal profit*. In our example, it will be added to the variable cost since it will depend upon the quantity sold. (In order to simplify the discussion, we assume that our businessman is able to balance his purchases and sales in any given period.)

If we assume that the salary required by the businessman is one dollar per period and that the normal profit is five per cent per period, the cost graphs will have the components shown in Figure 5.

While the ideas of a minimum salary to the owner and of a normal profit are theoretically simple and theoretically easy to distinguish, in practice it may be impossible for the businessman himself to separate them, and it will almost certainly be impossible for the outsider to measure them. The income which could be earned in other employment depends upon an evaluation of skills by prospective employers or potential success in a different

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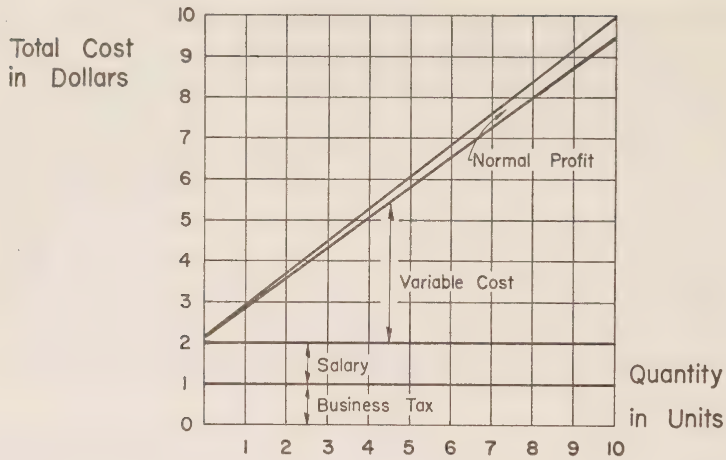

FIGURE 5: Total Cost of Hypothetical Single Product Business

kind, or different kinds, of self-employment. It may be possible to evaluate these alternatives only by applying for employment or by entering into a new business. The return which may be earned from alternative investment may be known, but the evaluation which the businessman places upon the risks involved in his own business and in others will be unknown to the outsider.

A further difficulty besets the outside analyst attempting to untangle these elements of cost. In our simple example, the analyst will be certain to see only the expenditures on supplies and business tax and a residual sum which is both the owner's salary and his return on investment. Even if a salary appears in the accounts of the business it may be a nominal figure which has no real significance. For these reasons, it is unlikely that the analyst will be able to make precise estimates of either the salary of the owner or the interest on his investment.

Let us now assume that our hypothetical businessman is so successful that he finds it necessary to move his business activities into a special building and to hire an assistant. The cost of the building will have characteristics unlike any of the costs which we have so far discussed. Like the business tax, the rent on his building, or the interest on his investment in it, is unlikely to change month by month as his business does well or poorly. Quite obviously he cannot add to or subtract from his building each month as his business volume changes. In this sense, the cost of the building represents a fixed cost to his business. But it is not as fixed nor as inescapable as the business tax, referred to earlier, which could not be escaped without going out of business altogether. If his business does very poorly, our businessman could

retract to his previous position, in which he did business from his home and had no real estate chargeable to the business. Thus the cost of the building has some similarities to those costs which we have previously termed "variable costs". The cost of the building can be regarded as a fixed cost provided that the owner believes that the present amount of space will continue to be appropriate for some time to come. On the other hand, when he feels that either more space or less space will be required, he will take steps to move the business into larger or smaller quarters. Economists refer to costs such as this as costs which are fixed in the short run and variable in the long run. The economists' definition of short and long run therefore has no consistent relationship to calendar time. What is usually meant by the long run is the length of time required by the businessman to adjust the size of plant in response to a larger or smaller volume of business.

Turning now to the assistant newly hired by our hypothetical businessman it will be clear that the cost of this assistant's salary has cost characteristics similar to those of the expense of the building. This employee is unlikely to be discharged at every point where there is a minor drop in business volume. The first adjustment will likely be to the amount of stock in trade held. On the other hand, in most businesses it calls for a less drastic and less long lasting adjustment to lay off or discharge one or more employees than to sell the land and building where the business is operated. In economists' terms, the cost of the employee can be viewed as fixed in the short run when one talks of situations in which adjustments are made only in the amount of stock in trade, but variable in the short run when one speaks of situations which give rise to changes in land and building. The definitions of short and long run change from moment to moment, depending upon the degree of adjustment which is being made. They can often be qualified as very long, very short, and so forth.

In Figure 4 we noted that, as the output of our small firm increased, the total cost per unit declined. We should now note that a second effect will be noticed if the business continues to grow. At some point, the building will become crowded, it will become more difficult to work and the inefficiencies involved will lead to higher costs. Similarly, as employees are added there will be new costs of supervision. Because of these new expenses the average cost will begin to rise. Economists therefore expect the cost curves of the firm to appear as in Figure 6 with average cost first declining and then rising as output increases, either in the short run, or, often, though not necessarily always, in the long run.

The railway equivalent of our small businessman is a railway giving service only between two points and carrying a single commodity. Before going into business this railway must construct a roadbed and lay tracks. Provided that the road is built to carry a minimum amount of traffic, the

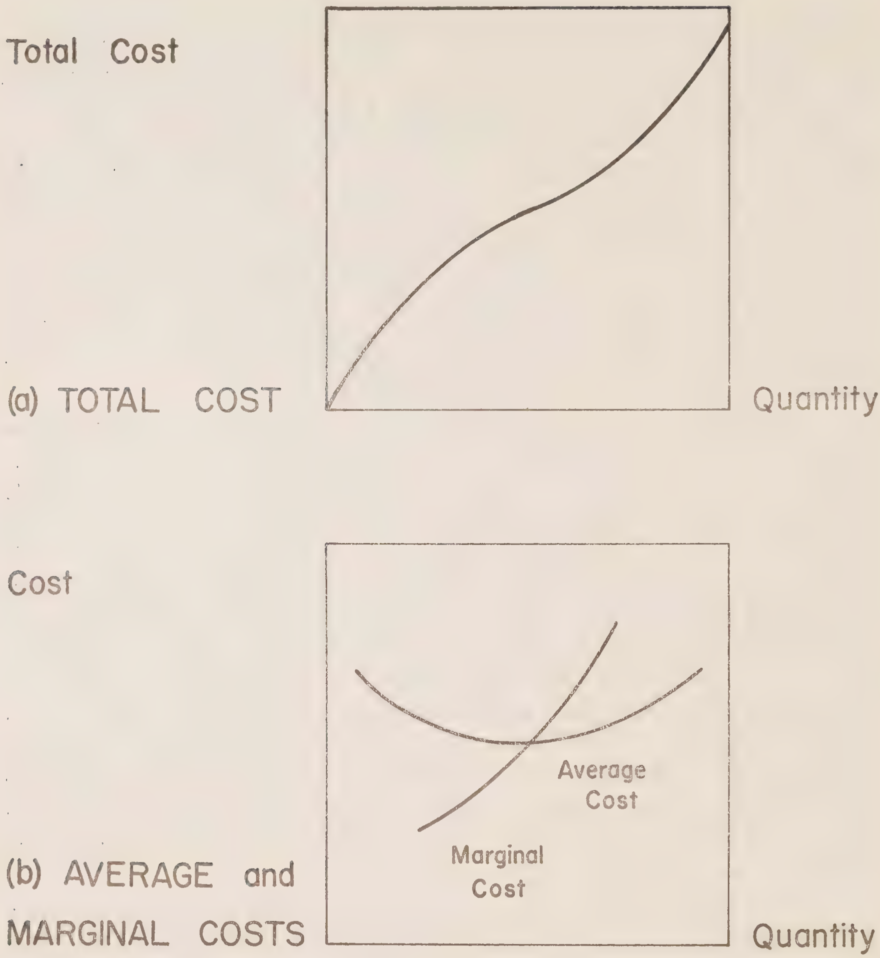

FIGURE 6: Typical Cost Curves

normal profit on this investment and the depreciation on it form fixed costs, for they can be escaped only by abandoning the business. If the traffic increases, more expensive rail will be required. Therefore, to some extent the investment will vary with traffic. In addition to the track, the railway will require cars in which to carry the traffic and motive power to move it.

The investment in these items, like the investment in heavier rail, will vary with traffic. As traffic increases, rolling stock will have to be bought. If traffic decreases, rolling stock will not be sold immediately to adjust to the new situation, but obviously investment in rolling stock can be adjusted downwards more readily than can investment in roadbed.

In addition to the investment in road and equipment, the railway must supply fuel to power the locomotives and a crew to operate the trains. In the case of the first of these, if there is greater or less traffic there will be more or less fuel required. We would expect then that the adjustment to changes in traffic volume would be almost instantaneous. That is that fuel would be a variable expense in the extremely short run. If the railway operation was sufficiently large that a great number of crews were available, crew wages could also be variable in the extremely short run, since crews could be laid off and re-hired to adjust to changed requirements without affecting the efficient operation of the railway. If on the other hand, the railway operation was small, the cost of crew wages would not be as variable in the short run as would fuel cost. At some minimum point, crews would be required to stand idle (or would at least demand the equivalent in pay) since there would not be sufficient traffic to employ them full time, yet there would be too much traffic to be moved without them. Exactly the same effect is created when overtime is worked by a smaller crew at premium rates. The cost of wages would then be variable only in a longer run than fuel costs. However, some part of fuel costs and crew wages may appear fixed since the railway may wish to preserve regular service even with a small amount of traffic offered.

The most important cost to the railway for a specific movement is the marginal cost. That is the increase in variable cost caused by increased traffic. If the rate received is less than marginal cost, the railway will be worse off the more traffic it receives. If the railway receives more than marginal cost, it will be better off carrying the traffic than not, some contribution will have been made towards paying the fixed costs. The marginal cost of the traffic is, therefore, the minimum below which the railway will not wish to have its rates fall. We will note later (Chapter 5) that in some situations the railway must receive more than marginal cost for at least some of its traffic to survive.

The discussion on the previous pages indicates one of the problems of applying marginal costs. There are a multitude of differing marginal costs. The appropriate marginal cost is determined by the degree to which it is assumed that adjustments will be made in the plant in response to a particular change in traffic. But the degree to which adjustments are made in the plant will depend upon the timing as well as the amount of traffic which it is expected will be moved. For example, suppose that the contents of a large

automobile junkyard become available as scrap for a steel mill and that it is known that, once the present contents are moved, there will be no shipments in the foreseeable future. In such a case, the railway would use existing equipment at otherwise idle times. If sufficient trains were already running along the route, and if the motive power were sufficient to pull larger trains, the additional cost would be confined to the cost of fuel, crew wages and locomotive time required for switching, and the cost of the extra fuel required to haul the scrap from yard to mill. But if it were believed that the movement would be repeated from time to time, it would have to be assumed that extra rolling stock would be required since it would not always be possible to use otherwise idle cars. Similarly, it would have to be assumed that, on the average, the railway would be required to have more motive power available. Under these latter assumptions, the variable costs would rise more quickly, and the marginal cost would be higher than under the shorter run assumptions of a once-only shipment. Similarly, the marginal cost will be higher if a periodic movement occurs at times when the railway is carrying a peak load than it will if the movement occurs at off-peak periods.

The costs which are discussed in the last paragraph have also been labelled the incremental costs, that is, the additional cost which will be encountered with an increase in traffic from a given level. In their cost estimates to the Royal Commission, the Canadian Pacific and Canadian National presented decremental costs, the costs which would be escaped if traffic decreased from a given level. These are sometimes known as avoidable costs. Their estimates were estimates of the variable cost which would be avoided if they did not engage in the transport of grain to export positions. Since the railway estimates were based on linear cost relations such as those presented in Figure 5, decremental and incremental costs would be numerically equal if each were based on the same assumptions as to the extent of plant adjustment.

The railway estimates were also based on very long-run analysis. They included amounts to cover the cost of lines which were designated as "solely-related" to the export grain trade. These were lines on which the traffic is preponderantly grain but on which, except for a very few lines, other products were, in fact, carried. For this reason it was suggested that they be designated "substantially-related" lines, a term which appears more accurate. It was claimed that these lines are maintained for the export grain trade and that if this trade did not exist the lines would disappear. Therefore, the cost of maintaining these lines was included as a part of the variable cost of moving grain. In the sense that transportation between any two points can be considered a business which is separate from transportation between any other two points, the railroads, by including these maintenance costs, indicated that they would abandon a part of their business if it were not for the grain

trade. In this sense, the railways cost estimates were based on a very long-run analysis in which almost all costs are variable.

If a business has only one product, or a railway carries only one commodity between only two points, all the expenses are due to the one product or to the transport of the one commodity. When more than one product, or the transport of more than one commodity is involved, a new series of problems is created. Some part of the expense will arise from the production of each product or commodity, but how much should be charged to each? It may be that some expenditures are required only for the transport of one commodity. For example, coal might be carried in hopper cars and lumber in box cars. If these cars are used only for these commodities the cost of each kind of car can be charged directly to the appropriate commodity. Suppose, however, that both commodities are transported in the same train. The cost of the locomotive, of the fuel, and of the crew will then be common to the transport of coal and lumber. These common costs cannot be charged directly to the commodities carried but must in some way be divided between them. The methods used to do this will be discussed in the following chapter.

A particularly interesting type of common costs are joint costs. These are defined as the costs of producing two products whose production cannot, for physical reasons, be separated. For example, in some gas fields, crude oil and sulphur are produced together. In railway transport a movement of equipment one way must ultimately be matched by a return movement. Passenger train service provides a clear example of a railway activity in which the movement of equipment in one direction on a route is often followed by a movement in the opposite direction on the same route. If the product which the railway is creating is viewed as the provision of capacity to transport a given number of passengers from one point to a second, it will be seen that equal capacity is provided in the opposite direction. The costs of moving the equipment away and back are therefore sometimes referred to as joint costs.

There is no way in which joint costs can be attributed specifically to one of the joint products. By definition, these must be produced in a given ratio. Therefore, an increase or decrease in the production of one product must be accompanied by an equi-proportionate increase or a decrease in the production of the other. We can estimate the cost of the package but not of the individual commodities. If the joint costs are being paid through the transport of one commodity, any payment by a second commodity, over those additional costs specifically attributable to the second commodity, will be a contribution which can be used either to increase the profitability of the railway or to lower the rates on the first commodity without impairing the railways' financial position. In the trucking industry such rates are frequently given and labelled "back-haul" rates. Unfortunately, however, the clear-cut

conditions under which it can be seen that "back-haul" rates are applicable are not often present in railways of the nature of Canadian National and Canadian Pacific. (The transport of goods inbound from the Port of Churchill may be an exception.) Equipment is designed to carry many commodities, and it may carry goods over many routes before returning to the starting point. The complications of determining the extent to which the costs of these movements are jointly related are overwhelming. In practice, therefore, simplifying assumptions must be made in order to make the problem manageable. The most important of these assumptions is an assumption that all costs which can be traced to a movement of traffic can be charged or assigned to that traffic without regard to the joint nature of the costs of moving equipment. This procedure, necessitated by the complex nature of the operation of large railway systems, can handicap the railway in competitive pricing situations where "back-haul" pricing would attract business with low but still advantageous revenues. On the other hand, it cannot be claimed that this procedure is disadvantageous to the shipper since it merely forces each to pay a share, proportionate to his use, of joint facilities rather than allowing one to pass the entire cost to another on the basis that "the second will pay for it anyway if I don't".

A number of phrases which are sometimes used in discussions of costs have not been used in this report. One of these phrases is "out-of-pocket costs". As used in the railway industry the phrase appears to mean marginal cost as given above. However, many economists do not include depreciation in their out-of-pocket costs. So far as it is possible, it seems better that the phrase should be reserved for the latter use since for many problems it is desirable to have a term which considers only the flow of cash. For that reason the term out-of-pocket costs will not be used. In some analyses, costs are divided into two groups called "prime cost" or "direct cost" on the one hand, and "over-head cost" or "burden", on the other. This classification seems to be made in one of two ways. The first method is to draw a distinction between those costs which can be traced directly to the productive process itself and those which are traced to functions ancillary to production. In these analyses, costs such as those for supervision, sales and insurance are lumped as overhead while labour and materials used directly in production are called direct. The second method of classification distinguishes those costs which can be related specifically to a productive process (direct) and those costs which are common to one or more processes or which relate to other than production functions (overhead). Using this method, some part of the costs of supervision would be included as direct costs. The railways avoided this terminological difficulty by the use of the terms "variable" and "fixed" costs. The variable costs of the railway analysis include costs which, under either of the last two definitions, would be called overhead.

Methods of Estimation

The accounts of the Canadian National and Canadian Pacific Railways are maintained in accordance with the "Uniform Classification of Accounts" prescribed by the Board of Transport Commisisoners. The Uniform Classification divides revenues and expenditures according to the service performed in the case of revenue, and according to the function performed in the case of expenditures.

Expenditures are classified under approximately 140 titles. These are grouped into twelve general classes:

1. Road Maintenance
2. Equipment Maintenance
3. Traffic
4. Transportation—Railway Line
5. Miscellaneous Railway Operations
6. General
7. Equipment Rents
8. Joint Facility Rents
9. Railway Tax Accruals
10. Express Operations
11. Commercial Communications Operations
12. Highway Transport (Rail) Operations

The railways keep accounts of most of their expenditures by divisions. Certain expenditures, however, are recorded only for the system as a whole.

While the classified accounts inform us of the amount of money spent on various activities, they do not aid us in determining the relationship between the work performed by the railway and the expenditures on the various tasks outlined in the accounts. The basic problem of cost estimation is that of explaining the expenditures shown in the accounts in terms similar to those of Chapter 2.

The first step in this analysis is to determine the kinds of work which are performed by the railway. Basically this work is the transport of a

certain tonnage of goods over distance. This is simply expressed as *ton-miles,* the product of the number of tons carried by the distance they are carried. Work is also expended upon hauling the vehicle in which the goods are carried. It is, therefore, convenient to measure *gross ton-miles.* In practice, trains carry loads of different commodities which must not only be carried between centres of population but also must be gathered from different locations, distributed between trains, and delivered to different locations within the same centre of population. The work performed in these switching movements can be measured by the number of miles travelled by locomotives in switching service, either in the switching yards or by way-trains at various points. The number of *yard and train switching miles* is not as precise an estimate of work performed, in terms of physical energy expended, as the number of yard and train switching ton-miles would be. As an explanation of cost, however, it is superior since it reflects the complexity of railway traffic movement, and this, rather than the weight moved, is the cause of expenditure for switching service. Finally, some expenditure is probably due to the movement of trains rather than goods. To illustrate, if 100,000 tons is moved in twenty trains, less cost will be entailed in controlling train movements than there would be if the same goods were moved between the same points, in the same calendar time, but in fifty trains. The work which gives rise to these expenditures can be measured in *train-miles.*

In addition to these basic measurements of work there are a number of operations which occur, or conditions which exist, which may explain certain expenditures. For example, the cost of maintaining locomotives may be due to the miles travelled by locomotives, or the cost of maintaining roadway may be related to the nature of the terrain over which the road is built. These specific operations or conditions will be discussed in connection with the cost studies presented before the Commission.

Once the basic units in which work is measured, or by which expenditure is explained, called "output-units", have been decided, the relationship between these units and expenditures must be determined.

Some expenditures may relate only to the movement under study. With these there can be no problem. They can be entered directly from the accounts of the company as costs of the movement.

Those expenses which are related to more than one kind of movement are more difficult to analyse. As an example, we may consider expenditures caused by the maintenance of tracks and roadbed. One approach might be to argue that the track and roadbed are there, that they must be maintained and that, therefore, the costs of this work represent a fixed cost, at least in all but the very long run. There appears to be evidence that at a period

around 1900 a theory very similar to this was held by most railway managements. At any rate it was commonly held that about half the total costs of a railway were fixed.[1]

At the other extreme, it can be argued that since the track exists to carry goods, the entire cost of maintaining it is due to the traffic over it. The maintenance expenditure would then be divided by the number of gross ton-miles. Each gross ton-mile would be assumed to cause this much expenditure. Observation would soon show that this figure varied widely. For example, the average experience in the years 1956 to 1958 of the line-haul divisions of the Canadian Pacific Railway varied from a low expenditure of $0.25 per thousand gross ton-miles in one division to a high of $4.84 per thousand gross ton-miles in another.

A third point of view could be argued, that each of the two extremes above has something of the truth and that a proper analysis should seek to assess both the influence of traffic and the possibility that some expense is caused by the existence of the track, that is, that there can be some expense caused by the necessity to preserve minimum standards of repair. Expenses which are common to more than one activity may be related to one of the output variables by observing how the expenses vary in relation to variations of the output variables. These observations may be carried out for a single economic unit, such as a firm, an industry, or a country—over a number of different days, weeks, months, or years. In this case, the analysis is known as time-series analysis. On the other hand, the observations may be of a number of economic units at the same point in time. This is known as cross-section analysis. Cross-section analysis has the advantage that changing prices and wages do not create as difficult a problem as they do in time-series analysis. On the other hand, if cross-section analysis is carried out, using various companies as the observations, differences in management practices caused either by differing viewpoints on sound practice, or by financial ability, may introduce variations in the cost-output relationships.

If one wishes to examine the manner in which an expenditure varies with some output unit such as train-miles, a simple procedure is to plot on a graph the observations of expenditure measured along one axis and train-miles measured along the second. A graph showing such hypothetical data is shown in Figure 1.

A glance at this graph indicates that those cases in which train-miles are higher have higher expenditures while those cases in which train-miles are lower have lower expenditures. Inspection of this graph indicates that a line drawn from the point where both train-miles and expenditures are zero

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[1] Cf. Healy, K. T., *The Economics of Transportation in America,* New York, The Ronald Press Co., 1940, p. 194-7.

(the origin) through the point where they are both five, would fall approximately in the middle of these points. Statisticians use a method known as "least-squares" to determine where the line would fall. They would describe such a line as representing the equation:

$$E = a + bM$$

This can be translated as "Expenditure in dollars is equal to a constant number of dollars, plus some number of dollars times the number of train-miles". This kind of analysis is known as regression analysis. Since the relationship between expenditure and train-miles has been represented by a straight line, the relationship is called *linear regression.*

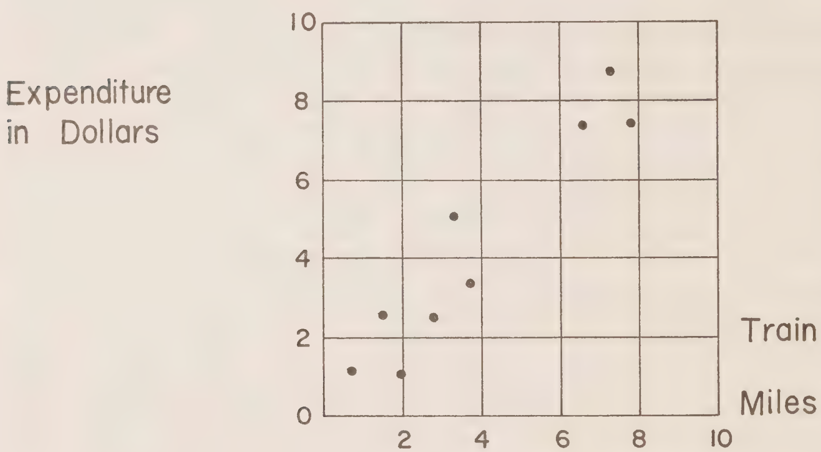

FIGURE 1: Hypothetical Cost-Output Data

Returning to our example, the analyst who wished to examine track and road maintenance costs and who allowed the possibility that both traffic and the miles of road have an effect might now argue as follows.

"I know how many miles of road there are in each division of this railway. I also know the maintenance expense and the gross ton-miles in each division. If I divide the maintenance expense by the number of miles of road, I will be rid of the effect of miles of road, since in each division I

will now be dealing with the maintenance expense per mile of road. By a similar treatment I can find the traffic density as gross ton-miles per mile of road. If I plot these on a graph, I can observe the effect of traffic density on road maintenance expense after compensation for the effect of miles of road."

Figure 2 shows such a graph. It is based on data for the Canadian Pacific Railway for the years 1956 to 1958. The straight line was "fitted"

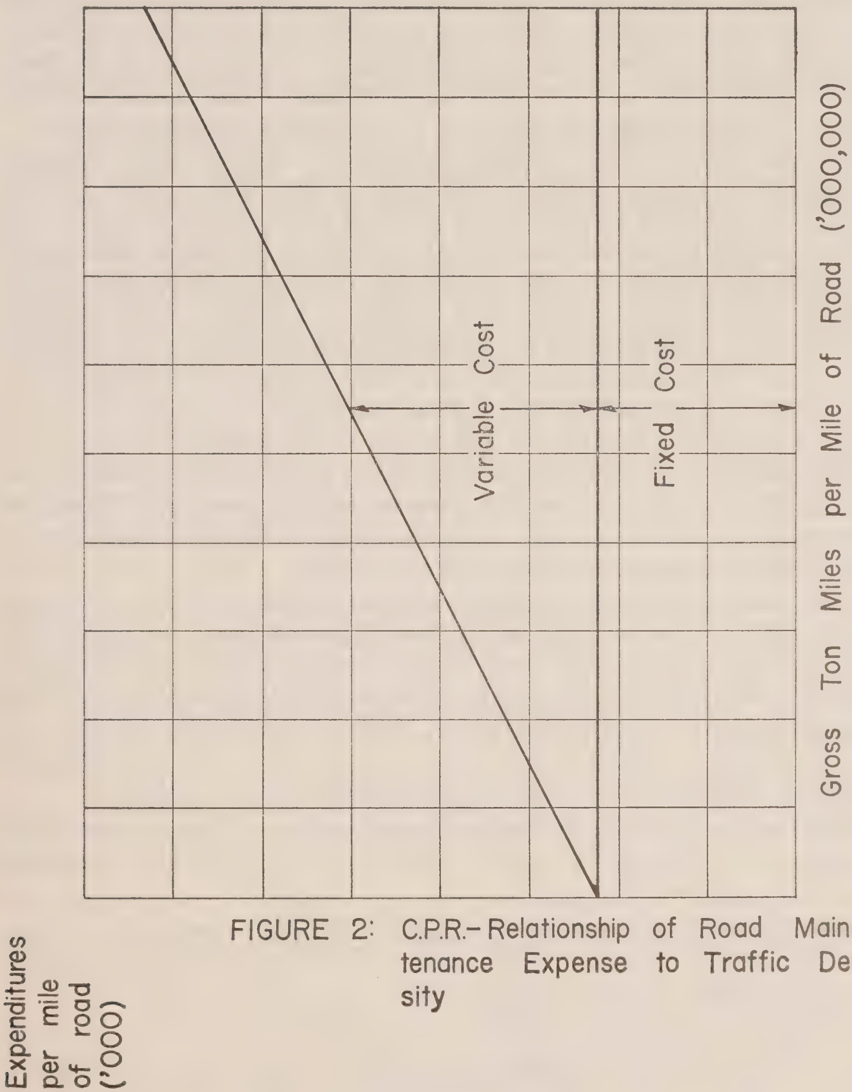

FIGURE 2: C.P.R.–Relationship of Road Maintenance Expense to Traffic Density

to the data by the method of least squares. The equation which it represents is "Expenditure per mile of road equals $2,216 plus $0.255,81 per thousand gross ton-miles per mile of road". Examination of Figure 2 shows that it is similar in form to Figure 4*a* of Chapter 2. The amount of $2,216 can be viewed as a fixed cost, the remaining amount below the line of regression may be viewed as the total variable cost.

Since both expenditures and traffic are expressed as amounts per mile of road, some means must be found to return to the original units—gross ton-miles. The Interstate Commerce Commission of the United States embodies in its rail-cost formula, known as Rail Form A, a method which the ICC refers to as a per cent variable. An analysis of the type illustrated in Figure 2 is carried out. The total cost is measured at the average density. (If a least squares analysis has been performed the line of regression passes through the point of average total cost and of average density.) The variable cost is then taken as a percentage of the total cost at this average density. In our example, the per cent variable (1441 ÷ 3657) is 39.4. On the average, it is then taken that 39.4 per cent of the expenditures vary with traffic density. Since the number of miles of roadway is assumed, for this analysis, to be fixed, this is tantamount to assuming that 39.4 per cent of the expenditures vary with gross ton-miles. By taking this proportion of the expenditure and dividing by the total number of gross ton-miles the variable expense per gross ton-mile is estimated. In our example, the total expenditure was $54,084,481. The variable portion of this (39.4 per cent) would therefore be taken as $21,309,285. Dividing by the number of gross ton-miles (75,564,756 thousand) one estimates a cost of approximately $0.28 per thousand gross ton-miles for the maintenance of track and roadbed.

Use of the per cent variable, measured at the average, is recommended by the ICC staff for problems of comparing costs of groups of railroads in different regions. In the case of the Canadian railroads this would be a suitable device to use in analysing the cost of traffic which moves over the whole system. As the ICC staff have noted, "at lower traffic densities the per cent variable would decrease while at higher traffic densities it would increase".[1] Therefore, if one attempts to find the cost of a movement which occurs only on a part of the railway account must be taken of the traffic densities in the divisions in which the traffic actually moves. The use of the "per cent variable" is inappropriate or at least needlessly time-consuming. An easier method is to deduct the "fixed cost" from the expenditures in each division and then to divide the remainder by the number of gross ton-miles for the division.

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[1] Interstate Commerce Commission, *Explanation of Rail Cost Finding Procedures and Principles Relating to the Use of Costs,* Washington, D.C., 1954, p. 73.

Technical objections to the ICC procedure have been raised.[1] Apart from these we may note that if we are interested in determining the effects on costs of variations in both the maintenance of miles of road and the traffic carried, the procedure of the Rail Form A gives only one-half the required information. It would, of course, be possible to carry out an analysis as outlined above and then to perform a similar analysis after dividing both the expenditures and the number of miles of road by the number of gross ton-miles. Unfortunately, although this would give estimates of the effects of both variables, there is no way of telling whether the estimate of the effect of variations in miles of road is consistent with the estimate of the effect of variations in traffic.

A procedure exists which frees us of much of the inconvenience of the foregoing type of analysis, meets the technical objections and gives consistent estimates. The method of "least squares" was mentioned on page 212, as a method by which an equation of the form $E = a + bM$ could be found to estimate the relationship between expenditures and the number of miles of road maintained. The same method can be extended to cover the cases where the expenditure is believed to depend upon more than one variable. In the present example, the relationship might be represented by the function:

$$E=a+b_1M+b_2(GTM)$$

This would be translated as "Expenditure in dollars is equal to a constant number of dollars, plus some number of dollars (b_1) times the number of miles of track, plus some number of dollars (b_2) times the gross ton-miles carried over the track". Graphically, the cost relationships would be shown separately as two lines, each of which would indicate the changes in expenditure which would take place in association with changes in one of the output variables if the second output variable were held constant. Where the expenditure is related to two or more output variables, and where the relationships are assumed to be straight lines, the analysis is known as *multiple linear regression.*

In certain cases it is assumed that the relationships can be best described by curved lines. In such cases, the analysis is known as *curvilinear regression.*

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[1] See, for example, Meyer, J. R., Peck, M. J., Stenason, J., and Zwick, C.: *The Economics of Competition in the Transportation Industries,* Cambridge, Harvard University Press, 1959, p. 275.

Although the ICC method is now criticized by many railway cost analysts, it is worth paying tribute to the great step forward which its origination, in 1938 by Dr. Ford K. Edwards, represented. Comments on the development and limitations of "Rail-Form A" are given in R. L. Banks and Associates: *Study of Cost Structures and Cost Finding Procedures in the Regulated Transportation Industries,* Washington, D.C., 1959, p. 2-23 to 2-29, 3-7 to 3-8 and 3-12 to 3-14.

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In addition to describing the relationships between the expenditure and the output variables, the analyst usually wishes to know how well he has accounted for variations in expenditure. For example, in the illustration of Figure 1, it appears that the points would fall fairly close to the straight line taken as exhibiting the underlying relationship. On the other hand, in Figure 3, it is clear that if a straight line were fitted to the data a relatively large

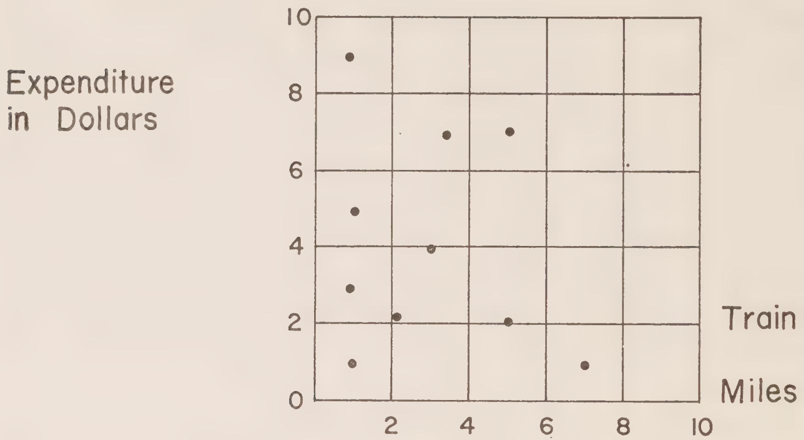

FIGURE 3: Hypothetical Cost-Output Data

number of points would fall far from the line. In fact, the average expenditure per division might give almost as close an estimate of the expenditure in any division as an estimate based on train-miles.

To indicate the degree to which he has succeeded in explaining the variation between divisions the statistician uses measures known as the coefficient of correlation and the coefficient of determination. These are symbolized as r and r^2 in the case of simple linear regression, and as R and R^2 in the case of multiple linear regression. As the symbols indicate, the coefficient of determination is the square of the coefficient of correlation. In the next chapter we will make use of the coefficient of determination (r^2 or R^2) which can take values between zero and one. A value of zero indicates that there is no (linear) relationship between changes of the values of the

variable to be explained and that used as the explaining variable. A coefficient of one indicates that there is a perfect linear relationship between the two variables.[1]

Since perfect correlation is rarely, if ever, attained in railroad costing, the relationship which is estimated between the expenditures noted and the output units will be an average relationship over the system. In some divisions or subdivisions the expenditure will be less than one would expect on the basis of the estimating procedure, in others it will be higher. One of the advantages of the statistical method is that estimates can be made of the probability that the observed expenditures will depart by more than a specified amount from the quantities which would be estimated by an application of the regression equations. Further, estimates can be made of the probable limits of error in estimating the regression coefficients, the "b's", of the regression equations. The most important use of these latter estimates is that of testing whether a regression coefficient reflects a true relationship between the variables or is the reflection of random influences in the basic data. Tests of this type are known as tests of statistical significance.

The logical nature of these tests can be illustrated by a simple example. Let us suppose that it has been suggested that the average height of boys of a particular age in a given school is 65.7 inches. Ten boys of this group, chosen at random, are measured. Their heights are found to be as given in the first column of Table I. The average height of the ten boys is 63.1

TABLE I—DATA FOR COMPUTATION OF STANDARD DEVIATION

Height (inches)	*Deviation from average*	*Square of deviation*
65	1.9	3.61
60	−3.1	9.61
61	−2.1	4.41
61	−2.1	4.41
63	− .1	.01
66	2.9	8.41
64	.9	.81
60	−3.1	9.61
62	1.1	1.21
69	5.9	34.81
63	0	76.90

[1] It should be noted that it is the relationship between *variations* in the values of the two variables which is measured. In the particular case where the relationship between the two variables could be represented by a horizontal straight line, the coefficient of determination will be zero since all possible changes in the variable measured horizontally will be accompanied by a change of zero in the variable measured vertically, *i.e.*, there is no relationship between changes in the two variables.

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inches, but some are taller than 65.7 inches. Should we conclude that the average height is unlikely to be 65.7 inches? Or is it likely that the smaller average height of our sample is caused by the chance inclusion of a high proportion of smaller boys? To answer this we first ask how much variation there is in heights. The amount by which each boy varies from the average height is shown in the second column of Table I. The total of the deviations from the average is, of course, zero. It would be possible to ignore the signs and compute the total absolute variation of 23.1 inches and the average absolute variation of 2.3 inches. In fact, statisticians get rid of the negative signs by squaring the deviations as in the third column of Table I. This procedure also gives greater weight to the observations which are farthest from the average. Dividing by ten and taking the square root we arrive at a measure of the amount of variation of 2.77 inches.[1] This measure is known as the *root-mean-square deviation* or the *standard deviation.*

The reason for using this measure of dispersion or variation is that, provided the variations are random,[2] it is known how often deviations of a given *size,* measured in multiples of standard deviations will occur. For example, if a very large sample were taken, about 68 per cent of the observations would fall within one standard deviation of the mean, about 95 per cent within two standard deviations, and over 99.7 per cent within three standard deviations.

The deviation from the mean of an observation, divided by the standard deviation is known as the statistic "t". In the example we are discussing, the standard deviation is 2.77 inches. The standard deviation of the mean is found by dividing the standard deviation of the original observations by the square root of the number of observations. In this case, $2.77/\sqrt{10}=2.77/3.33=.83$.

A statistician will then ask the question: "If the average height of all the boys were, in fact, 65.7 inches, what chance is there that the average height of a random sample of ten boys from the group would be 63.1 inches, that is 2.6 inches less"? He finds the statistic "t" is $2.6/.83 = 3.1$. He would expect a deviation of this magnitude to occur less than one per cent of the time. The statistician could then be expected to say that, since he would expect such a result to happen only once in more than a hundred samples, he believes that the difference cannot be due to chance and that he therefore rejects the hypothesis that the average height of the larger group is 65.7 inches.

In this case, the statistician applied a "t-test" at the one per cent level of significance. If, for example, from general observation, he was con-

[1] For simplicity, the correction of dividing by $(n-1)$, to correct for the bias in estimating the variance from a sample, has been ignored.

[2] That is, provided the variations may be presumed to be distributed according to the normal curve of error.

vinced that the average height of boys in the larger group (the population being studied) was, in fact, 65.7 inches, he might use a one-tenth of one per cent level of significance. He would then say that, "if this difference could have arisen by chance only once in a thousand times, I will assume that it arose because my hypothesis that the average height is 65.7 inches is wrong. Otherwise, I shall accept the 65.7 inch hypothesis as not disproven". On the other hand, if he had strong doubts of the possibility that the 65.7 inch hypothesis could be true—or if he felt that an error in accepting that hypothesis would be more costly than an error in rejecting it—he might use a five per cent level of significance. With this point of view, he would say, "If this difference could have arisen less than one time in twenty by chance, I will assume that it did not arise by chance and will not accept the 65.7 inch hypothesis".

Two points should be noted when considering this reasoning. The first is that the statistician does not prove a fact directly. Rather, he eliminates alternatives on the ground that they are unlikely. Having shown that the alternatives are unlikely, he accepts a hypothesis as the most plausible in view of the evidence available. The second point is that the level of significance is subject to the choice of the statistician: he must decide upon the degree of improbability of obtaining certain results which will persuade him that he is not observing the mere operations of chance.[1]

The computation of the standard deviations of various statistics differ according to the statistic being tested. The general philosophy of testing remains, however, that just outlined.

A most important group of tests, which will be referred to in Chapter 4, are those in which the statistician estimates the probability that a value derived from a sample could have arisen from a population (that is, the larger group of all possible cases of the kind being studied) in which the true value was zero. Thus, if a regression line of the type

$$E = a + b0$$

is fitted to a series of expenditures and the related series of output units, values will be found for the coefficients "a" and "b". The statistician will wish to assess the probability that, if, in the parent population, the true value was zero, the value which was found for the sample could have arisen by chance.

[1] An interesting example of this choice of significance level is the evaluation of experiments in extra-sensory perception. Some psychologists and biologists say that, even if statistical tests indicate that the results of such experiments could happen by chance only once in millions of times, they will not accept the possibility that these results indicate the existence of extra-sensory perception. These persons are using, in effect, a zero per cent level of significance in this case.

The probability that a value of "t" of a given size will arise by chance depends upon the number of observations or cases which were included in the sample studied and the number of parameters (or "constant values", such as "a" and "b" above) which are estimated from the data.

Most analyses assume that the relationships between expenditures and productive activities are linear. In the first place, linear analyses are much easier to perform. The arithmetic involved in dealing with curved lines is more laborious than that required for straight lines. In the second place, the curvilinearity which can be demonstrated in economic analyses is often very slight, or non-existent, so that straight lines give, at worst, good approximations of the demonstrable relationships.

A lack of apparent curvature in the relationship between expenditures and activity can be caused by limitations in the range of observations. For example, if engineering analysis has indicated that the average cost of a particular process drops quickly as the level of production is increased to some value, then shows little change through a particular range, and then rises quickly, there will be a strong tendency for all plants to fall in the mid-range. Observations of the costs and outputs of such an industry will show little if any sign of curvature simply because no plants are built in the range of decided curvature.

The logic of statistical tests of significance also militates against the adoption of curved representations. A common method of representing a curved relationship is by a power series, *i.e.,* by an equation of the form,

$$E = a + b_1 O + b_2 O^2 + b_3 O^3 \ldots\ldots,$$

in which as many terms of increasing powers of the output units are taken as are necessary to describe the data adequately. Following the general method outlined above, the statistical test of significance is applied at each stage. Thus after the linear model is fitted ($E = a + b_1 O$), a second degree curve ($E = a + b_1 O + b_2 O^2$) is fitted.[1] The new model will always describe the data more adequately than the simpler one which preceded it.[2] The statistician normally will not accept this improvement unless he believes that the improvement is not likely due to random influences after taking account of the automatic improvement. One authoritative study indicates this point of view in these words:

> "The Steel Study does not reveal whether any tests were made of the reliability of the selection of a linear regression between the twelve annual values for output and total costs. A cubic or higher order equation might have been more appropriate. The fact that a higher order equation must necessarily fit the observed values of cost and output within narrower limits

[1] The values of the coefficients a, b_1, etc., will normally change at each step.
[2] Until the number of coefficients is one less than the number of observations.

does not, however, render the linear regression invalid. The difference in 'closeness of fit' of the linear and higher order equations must be large enough to be statistically 'significant'. Perhaps of even greater importance, the difference must be sufficiently large so that the higher order equation indicates more accurately the view of cost behaviour which figures in decision formation."[1]

This reluctance to move from linear analyses has ample backing in the well-established dictum of scientific investigation that the simplest explanation possible should be sought. However, it must be remembered that the level of significance chosen by the investigator reflects the strength of his opinion that the explanation being tested is likely. An analyst who is convinced that the curved relationships discussed in Chapter 2 are likely will demand that the evidence shows that they do not exist. On the other hand an analyst who believes that a large organization consists of a number of reproducible units will expect a linear relationship between cost and output and will demand proof that this is unlikely.[2]

While the arithmetic involved in estimating curvilinear relationships is more tedious than that involved in estimating linear relationships, it usually presents no serious analytical difficulties. Many non-linear relationships may be represented in linear form by means of transformations of one or more of the variables involved. For example, in the case of the power series which we have just discussed, the square and higher powers of the output variable are treated as new variables which have a linear relationship to the expenditures which are being explained. If a simple reciprocal is involved, a similar treatment is available. Suppose that it is believed that the price of a commodity at any given time depends solely and simply upon the supply available, and that it is believed that the relationship is such that when the supply is low the price is very high and that as the supply increases the price drops, quickly at first and then more slowly, to approach some minimum value, one of the forms which such a relationship may take can be represented by the equation:

$$P = a + b/S,$$

$$\text{or, } P = a + b(1/S)$$

Instead of attempting to deal directly with the values of "S", we first calculate the values of the reciprocal of "S", which we might term "R". It is then a straightforward job to fit the linear equation:

$$P = a + bR$$

[1] Committee on Price Determination, *Cost Behavior and Price Policy,* New York, National Bureau of Economic Research, 1943, p. 99-100.

[2] Cf. Smith, C. A., *Review of Statistical Cost Analysis,* by J. Johnston in American Economic Review, June 1961, p. 419.

Two interesting types of non-linear relationship can be treated by similar transformations. In a linear system, successive increases of equal absolute value in the explaining variable are accompanied by successive increases of equal absolute value in the explained variable. It may be believed, however, that successive increases of equal absolute value in the explaining variable are accompanied by successive increases of equal percentage in the explained variable. This relationship can be written as:

$$X = ab^{Y}$$

Taking logarithms, this can be written:

$$\log X = \log a + Y \log b$$

Substituting, $Z = \log X$, one has:

$$Z = \log a + Y \log b$$

Since both "a" and "b" are constants in this equation, their logarithms will be constant. The equation is, therefore, linear.

A similar transformation can be applied when it is believed that the value of the explained variable varies as some power of the explaining variable. This may be expressed as:

$$X = aY^{b},$$

or, using logarithms:

$$\log X = \log a + b \log Y$$

Substituting, $Z = \log X$ and $T = \log Y$, the equation becomes:

$$Z = \log a + bT$$

This transformed equation is linear in Z and T, log a is again a constant.

Of course, when transformations such as these are employed in order to develop a linear regression, the procedure must be reversed in order to make estimates in the original units.

Although a wide variety of non-linear relationships can be treated by means of transformations of the type which have just been discussed, grave difficulties do arise when the relationship between the cost and output units involves a mixture of additive and multiplicative terms which cannot be transformed into a simple linear equation. For example, it might be thought that wear and tear on track and roadbed, and therefore the cost of maintenance, depended upon the traffic over the road and upon some power of the

speed. An experiment could be planned to attempt an examination of the relationship between these elements. If the equation to be examined were,

$$\text{Cost } a = b(\text{Traffic in Gross Ton-miles}) + c(\text{Speed in MPH})^{d},$$

logarithms could not be used to transform the equation to a linear form. There seems to be no way in which such a suspected relationship can be examined in one step.

Empirical studies have not yet demonstrated that the expectations of economists' analytical models as outlined in Chapter 2 are universally realized in the industrial world. Some of the reasons have been outlined in the preceding paragraphs. Another important reason is likely that economic affairs are much more complex than the analysts have yet been able to reflect in their models. (This inadequacy will be evident in the following chapter when alternate specifications are discussed.) When an analysis of a particular industry is performed a greater or lesser amount of the variation in cost is left unexplained. Usually, at least as a working hypothesis, it is assumed that this residual variation is due to chance variations. When a large amount of variation is left unexplained, one is driven to the conclusion either that the role of chance is very large in economic affairs or that important elements of cost have so far eluded analysis. A single cross-section analysis will reveal only the amount of unexplained variation. Since random influences can be expected to have unequal impact on particular economic units in different periods of time, successive cross-section analyses of the same economic units should indicate the presence of persistent, and therefore non-random, effects. From the point of view of a regulatory body when it is deciding general questions which do not require precise cost estimates, the problems raised by these non-random effects may not be important. To a company management which may have to decide whether to lose business through failure to meet competitive prices or to lose money by accepting business at less than marginal cost, these problems can be of great importance when the disparity between the competitive price and the company's own marginal cost is small. So, too, they must be to any regulatory body which must rule on the rates so set.

To railway management, large variations of actual expenditures from those which would be expected from statistical analysis are important for another reason. It is to be presumed that, in setting up the statistical models of the railway cost structure, all activities or circumstances which it is believed might systematically influence the cost relationships have been taken into account. The amount of discrepancy between the estimated cost (as shown by the analysis) and the actual cost is a measure of the combined effects of efficiency of operation and of the insusceptibility of expenditures to managerial control. If one division, for example, has expenditures ten

per cent under those which would be expected, and a second has expenditures ten per cent over those which would be expected, the management of the first may be considerably more efficient than the management of the second division. Alternatively, the discrepancies may be due to random effects, that is to conditions over which management does not have control and which are not predictable. Of course, if an independent measure of managerial efficiency could be devised, the insertion of such a measure into the analysis would resolve this ambiguity. If the discrepancies are sufficiently large that management believes that they cannot be explained on the grounds of differing supervisory abilities, and if, over a period of time they persist, the cost analyst must pursue further the identification of the causes of cost variation. If, however, it is decided that the causes of cost variation have been decided satisfactorily, a decision must be made as to the degree to which the discrepancies between actual and estimated cost reflect the resistance of costs to control (random effects) and the degree to which they reflect differing supervisory abilities.

To this point the discussion of this chapter has assumed that the choice of output units (variations of which are expected to explain variations in expenditure) is a simple one. This is not so. As we will discover in Chapter 4, usually there are no unquestionable technical (*i.e.,* engineering) reasons for assuming that many classes of expenditure (as given in the Uniform Classification) are related to particular output units. Without clear technical grounds for a choice of output units, the statistical evidence received from our observations must be the grounds of our choice. From a statistician's point of view, the only way of choosing output units as suitable explanatory variables is to choose those which explain the largest amount of variation in expenditures. Unfortunately many of the output units tend to vary together. For example, as the number of gross ton-miles increases or decreases, the number of train-miles tends to increase or decrease.

The algebraic problem to which this gives rise can be illustrated by considering the problem of a cost analyst who is asked to find the cost of lemons and oranges. Assume that he is told that two housewives have purchased (a) 4 lemons and 6 oranges at a cost of 67 cents, and (b) 6 lemons and 4 oranges at a cost of 63 cents, respectively. The analyst will then perform a few simple algebraic manipulations and reach the conclusion that the oranges cost 7½ cents each and that the lemons cost 5½ cents each. If, however, he is told that the two housewives bought (a) 4 lemons and 6 oranges at a cost of 67 cents, and (b) 8 lemons and 12 oranges at a cost of $1.34, respectively, he will not be able to answer the question of how much oranges and lemons cost. His best answer will be that a package of 2 lemons and 3 oranges would cost 33½ cents. This is because in the second example the number of oranges and lemons bought by one housewife was

each an exact multiple (or fraction) of those bought by the other, as were the total amounts they paid.

Statisticians speak of two variables which vary in such a fashion that one is a constant multiple of the other as collinear; indeed, provided there is an *exact* linear relationship between the two variables of the form $X=a+bY$ they are known as collinear. (By exact we mean that one is precisely predictable from the other.) As two variables come closer to this exact relationship, they come closer to being changeable as far as the observing analyst is concerned and the effect of each becomes merged with that of the other just as the cost of the oranges and lemons became merged in the second example of the last paragraph. Regrettably, in dealing with random variables this confusion sets in before exact collinearity has been evidenced. Thus, for example, if gross ton-miles and train-miles exhibit a strong tendency to vary together, it may be quite impossible to disentangle the effects of one from the other with the methods of the statistician. Because of this indeterminacy, and because of the possible existence of non-linear relations, the analyst must often do a considerable amount of "fishing around" for reasonable cost-output relationships. It should not be surprising, then, if several analysts pursue different paths in their attempts to explain variations in a particular class of expenditures. What may be surprising is that beneath the arguments of the analysts lies a large measure of agreement upon the nature of the fundamental relationships involved and upon the proportion of the variation in expenditure which is explained by given sets of variables.

A difficulty of a different kind which arises in statistical cost analysis is that of separating the long- and short-run effects upon costs of changes in given variables. In fact, in cross-section analysis precise separation of these effects is probably impossible. The difficulty can be seen by reference to Figure 4. Here the outputs and expenditures per unit of a set of hypothetical firms are superimposed as dots, upon long- and short-run cost curves.[1] The dotted line indicates the average cost curve which would be found by statistical analysis. Since the nature of long-run average cost is that it is the lowest cost which can be achieved for a given output when all appropriate long-run adjustments have been made, the long-run cost can equal but never exceed the short-run cost. It follows therefore that the observations of cost and output which one can observe will seldom be on the long-run curve. More likely the observations will be somewhere above this cost curve.[2]

[1] In Chapter 2, long- and short-run adjustments were discussed. Short-run cost curves show the variations in cost which will occur with variations in output of plants of given sizes. Long-run cost curves show the minimum cost of various outputs as plant size varies.

[2] Cf. Borts, G. H.: *The Estimation of Rail Cost Functions,* Econometrica, Vol. 28, No. 1, January 1960, p. 108-131. See also Meyer, J. R., and Kraft, G.: *The Evaluation of Statistical Costing Techniques as Applied in the Transportation Industry,* American Economic Review, Vol. LI, No. 2, May 1960, p. 321-327.

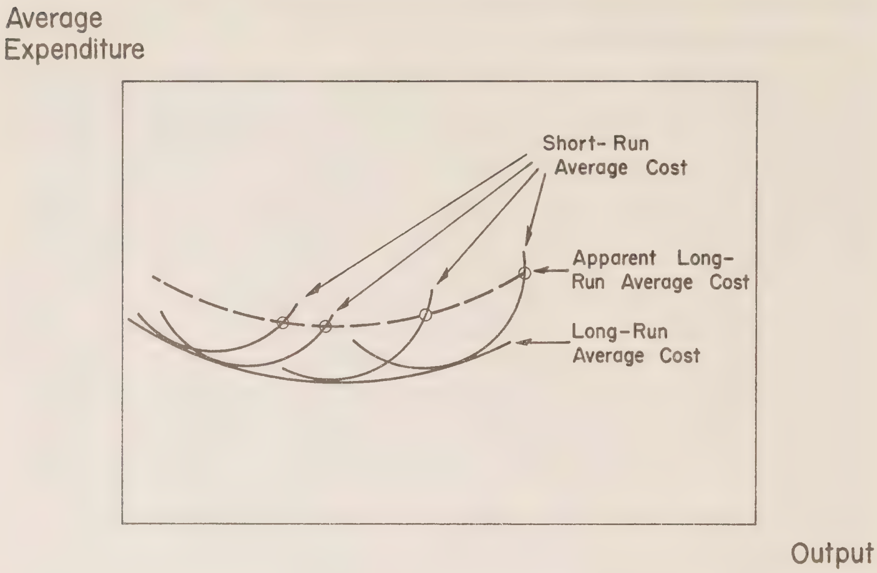

FIGURE 4: Effect of Short-Run Variations on Statistical Cost Curves

At first glance, this seems a crucial difficulty. However, there are mitigating factors. First, the upward bias which is caused by the movement along the short-run curve is a bias only in the estimation of long-run as opposed to short-run effects. It does not lessen the validity of the cost estimates and relationships as far as one is concerned only with the relationship in general between cost and output at a given moment of time, over the system. Second, if the range of outputs possible with adjustments of plant size is large compared to the range of outputs practical with any given plant size, the error will be small. Third, if the marginal cost is being estimated, the shape, rather than the absolute values, of the total cost curve, is the important characteristic. It is quite possible that the short-run characteristics of the industry are such that the shape of the long-run cost curves will not be affected.

In situations where one is employing marginal costs to judge rates, there seems, then, no reason to be unduly concerned with the problem of intermingled long- and short-run effects. We should, however, be on our guard to examine claims that "a long-run effect" has or has not been demonstrated.

If an error of the type discussed in the last paragraph is made, incorrect conclusions may be drawn as to the extent to which average costs will drop with increased utilization of plant.

When the analyst has decided upon the output units which he will examine and the relationship, if any, which they bear to expenditures, he must still decide upon the number of output units which are due to the specific movement or movements which he is analysing. Some can be taken directly from company records. For example, the weight of each shipment is recorded, as are the origin and destination. Provided the route is known, the weight of the shipment can be multiplied by the distance travelled to give the ton-miles generated by the movement. (Not all shipments are routed by the shortest available path between two points. Operating conditions may require a circuitous movement from time to time.)

Other output units must be assigned indirectly. Most trains do not carry one commodity only. Even if everything carried on that train has been shipped by carload lot, the expense caused by running the train must be apportioned to the various commodities carried. The problems encountered in assigning the output units can be as severe as those which are encountered in evaluating the impact of variations in output units upon expenditures. Obviously, if there is no traffic available trains will not run. But if some traffic is available, how many trains will run? If the traffic available drops or increases ten per cent, will the number of trains drop an equivalent amount? The methods of examining these problems must be the same methods used to discover the relationship between output units and expenditures, that is, observation and statistical manipulation of the data-including regression analysis where applicable.

The last few pages have recited some of the difficulties of cost analysis, with particular reference to railroads. To some it may seem that the uncertainties which beset cost analysts negate any contribution which they may have to offer. At times, those who are, by trade, professional cost analysts are undoubtedly among those who feel this way. Each, in viewing his own work at the moment of completion, may feel that this is as good a job of cost estimation as has ever been done. Yet each knows that, "When studying complicated joint product operations like railroading, there is likely to be no such thing as '*the* correct cost estimate' ".[1] If this be so, it may be asked, "why then bother to say anything"? The answer may be found in the words of an author who said:

> "As I understand it, statistics is not primarily for making objective statements, but rather for introducing as much objectivity as possible into our subjective judgements. It is only in limited circumstances that fully objective

[1] Meyer, J. R., Peck, M. J., Stenason, J., Kraft, G., and Brown, R.: *Avoidable Costs of Passenger Train Service,* Cambridge, Aeronautical Research Foundation, 1957, p. 5.

> statements can be made, although the literature of theoretical statistics is mainly concerned with such circumstances. The notion that it must all be precise is harmful enough to be worth naming. I shall call it the 'precision fallacy'. If we refuse to discuss problems in which vagueness is unavoidable then we shall exclude a large proportion of real-life problems from consideration. In fact every judgement involves vagueness, because when it becomes precise it is no longer called a judgement. Vagueness will not disappear if we bury our heads in the sand and whistle."[1]

There may be value in registering again that the purpose of a cost analyst, who is forced to resort to statistical (in the theoretical as opposed to the strictly numerical sense) argument, is to introduce as far as he can an objective orientation. The comments which appear in Chapter 4 of this report indicate some of the ways in which one can recognize the subjective or objective content in the report of a statistical cost analyst.

In the following chapters, there is an account of the presentation before the Commission of the costs and revenues of transporting grain from the Provinces of Manitoba, Saskatchewan and Alberta to export positions as given by the Canadian Pacific Railway Co. and the Canadian National Railways. The counter suggestions, given on behalf of the Provinces of Manitoba and Alberta and on behalf of the Alberta Wheat Pool, the Manitoba Pool Elevators, the Saskatchewan Wheat Pool and the United Grain Growers, are included *seriatim* as the various groups of accounts are discussed. Chapters 7 and 8 briefly discuss the passenger deficit and the costs of branch lines of low density.

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[1]Good, I. I.: *Significance Tests in Parallel and in Series,* Journal of the American Statistical Association, Vol. 53, No. 284, Dec. 1958, p. 799.

Chapter 4

The Variable Cost of the Grain Traffic

This Chapter comments upon the studies of variable cost presented by the Canadian National Railways, the Canadian Pacific Railway Company, R. L. Banks and Associates on behalf of the Province of Alberta and the Province of Manitoba, and by W. B. Saunders on behalf of the Alberta Wheat Pool, the Manitoba Pool Elevators, the Saskatchewan Wheat Pool and the United Grain Growers. Since most of the discussions before the Commission and in conferences with the Commission's consultants dealt with the presentation of the Canadian Pacific Railway, this Chapter will deal with the presentation of that Company in much greater detail than with the estimates of the Canadian National.

Section A of this Chapter deals with the estimation of the relationships between output units and expenditures, Section B with the estimation of the output units attributable to the movement of grain from Western Canada to export positions and Section C with some more general problems.

A. The Relations between Output Units and Cost

1. *Track Maintenance and Depreciation*

CANADIAN PACIFIC RAILWAY

Accounts Explained

202 Track and Roadway Maintenance	229 Roadway Buildings
208 Tunnels, Bridges and Culverts	266 Road Property Depreciation (part)
212 Ties	269 Road Machines
214 Rails	271 Small Tools and Supplies
216 Other Track Material	273 Public Improvements
218 Ballast	281 Right of Way Expenses

The Canadian Pacific explained the expenditures in these accounts by means of the following regression:

(1) Expenditures=		\$1,208,385.00		(2.32)
	+	\$1,136,811	per mile of track	(6.11)
	+	\$0.16475	per thousand gross ton-miles	(5.29)
R^2=.83	+	\$0.39053	yard and train switching miles	(2.19)

If this explanatory equation is compared with the explanation on page 214 of Chapter 3, it will be noticed that the estimated cost attributable to gross ton-miles has dropped from 28 cents per thousand gross ton-miles to 16 cents, and that estimates of the effect of miles of track and yard and train switching miles have been included on a consistent basis. The example of Chapter 3 was computed from the same data as that above (except that data for the four terminal divisions were not included in the former case). The figures in brackets are values of "t", on the assumption that the true value of the coefficient is zero.[1]

The Canadian National explained the same group of accounts with the exception that 266 (depreciation) was not included, and 270 (dismantling retired road property) was included. Their estimating equation was:

(2)	Expenditures=	$258,029		
		+ $866.17	per mile of road	(5.52)
		+ $187,888.2	per mile of tunnels	(3.54)
	$R^2 = .87$	+ $0.75687	per yard locomotive mile	(4.28)

The Canadian National believed that the nature of the terrain through which a rail line passes has some effect upon the cost of maintaining the line. As there is no direct method of measuring all the aspects of the terrain which might affect maintenance costs, miles of tunnel were used to indicate rough terrain. Using the number of miles of tunnel in this fashion does not mean that the Canadian National analysts believed that the existence of tunnels, in itself, caused an expenditure of $187,888 per mile. It indicates that, in their opinion, conditions which do cause such expenditures arise, in a division, in a fairly direct ratio to the number of miles of tunnels.

R. L. Banks and Associates presented a second explanatory equation for the Canadian Pacific accounts.

(3)	Expenditures=	$1,319,000		(1.41)
		+ $0.05745	per dollar invested in tunnels, bridges and culverts	(2.48)
		+ $0.3896	per train-mile	(5.58)
		+ $742.52	per mile of track	

The inclusion of the investment in tunnels, etc., was an attempt on the part of Banks to include in the analysis of Canadian Pacific expenditures some variable which would perform the function of miles of tunnels in the Canadian National explanation. As an explanatory variable it should be superior to miles of tunnels since it reflects the existence of rivers as well as grades, and since it reflects less severe variations in terrain than do tunnels.

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[1] The use of the "t" test is discussed briefly in Chapter 3.

Unfortunately, however, it also reflects the price level at the time of the investment. If the bridges, and so forth, were built at different times in different divisions, or if, for other reasons, the cost of similar structures varied between divisions, the investment in tunnels and bridges will reflect these price deviations as well as the differences in terrain. A measure in physical terms is to be preferred to investment if one is available.

W. B. Saunders and Co. used an index constructed on the basis of the tonnage ratings of locomotives on each section of road.

> "The tonnage rating of any given locomotive on different sections of the railway will vary inversely with the maximum adverse grade encountered. To a lesser extent, greater degrees of curvature will also cause lower tonnage ratings. Therefore, the reciprocal of the tonnage rating over each separate section of line was interpreted as an index of grades and curves for that section. For each section the lower rating in either direction for 1500 to 1800 horsepower diesel units was related to the estimated rating (5500 tons) for these units over level tangent track as a base. Wherever ratings for this class of unit were not given, the ratings for the class shown were converted to such a basis. To demonstrate the geographical distribution of grades and curves on lines which are important in the handling of statutory grain (Figure 2 was prepared) showing the indexes for the main line of the CPR from Vancouver eastward to the lakehead. This chart illustrates the non-random impact of grades and curves; but for costing purposes it was necessary to produce average indexes for each of the 31 divisions of the CPR. To this end, the individual sections making up each division were combined using the road mileage of the section as weights. The four terminal divisions were assigned an index of 100. The composite indexes for each division are shown in the Appendix."[1]

Like the Canadian National Railways' variable, miles of tunnels, this index is a physical, rather than a monetary measure of terrain. Like the R. L. Banks' use of investment, the index of grades and curves reflects more detailed variations in terrain than does miles of tunnels. It appears to be the best indicator of difficult terrain introduced in the hearings. After testing the index in its original form, the Saunders organization developed the following model:

(4) Expenditures $= -\$144{,}000$			
	$+\$794$	per mile of track	(4.6)
	$+\$480$	per mile of track	
		$\times$ (the grade index — 100)	(3.9)
	$+\$0.165$	per thousand gross ton-miles	(6.6)
$R^2 = .886$	$+\$0.709$	per yard and train switching mile	(4.3)

Against the use of some variable to reflect the changing terrain, it was argued that:

> "Owing to the random distribution of topography in the Canadian Pacific system, the omission of an explanatory variable to reflect topography does

[1] Transcript of evidence, *Hearings*, November 11, 1960, Vol. 117, p. 19497.

> not bias the cost coefficients in the Canadian Pacific track maintenance model; the constant term absorbs the effects of topography. If a proper measure of topography was included in the regression, its effect would be to reduce the constant cost without significantly altering the coefficients of the other explanatory variables. That is to say, it would not significantly alter the cost of moving export grain. The reason for this is that there is no correlation between topography and the output or size variables as used in the Canadian Pacific regression model."[1]

The relevant question is not whether topography is randomly distributed across the Canadian Pacific system, but whether it is randomly connected with the expenditures in question. To illustrate by a homely example, suppose that a statistician were called upon to explain yelps of pain coming from various members of a crowd. Were he to discover that some mischievous small boy was distributing shots from a pea-shooter in random directions into the crowd, he would still investigate any correlation between the persons hit by peas and the yelps of pain. The latter part of the quoted paragraph suggests, of course, that it was this definition of randomness which we are invited to consider.

It is quite true that if there is no correlation between topography and the output and size variables used in the regression models, there will be no change in the coefficients of the other explanatory variables when a new variable to reflect differences in terrain is introduced into a linear model. The contention that there is no correlation was supported by the argument of this paragraph:

> "Topography affects track maintenance and depreciation expense in several different ways. Amount and characteristics of curvature, extent of gradient, subgrade conditions, amount of precipitation, rivers, drainage patterns and frequency of highway crossings are all characteristics of topographical significance which have an effect on track expense. To develop any comprehensive basis for adequately measuring all of the various effects of these features on track maintenance would be most difficult, time-consuming and expensive. It is our view that such a procedure would not be warranted and would not alter the results of Canadian Pacific's track maintenance and depreciation regression model to an appreciable extent since there is an overall random distribution of topographical influences throughout the system. Although certain topographical features predominate in some areas, these are substantially offset by different topographical features which predominate in other areas. For example, in mountainous terrain somewhat greater expense is incurred for track lining and gauging and for depreciation of rails and ties as a result of the heavier curvature and gradients which prevail, as compared to other territories, but this is compensated for by the better subgrades provided which minimize the amount of surfacing and shimming required, the well defined drainage courses which reduce the incidence of subgrade erosion, the comparative lack of vegetation to control and the extremely low incidence of highway or road crossings to maintain. Where maintenance and depreciation of tunnels is incurred due to the presence of such structures, there are no

[1] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22537.

> bridges, culverts or highway crossings to maintain or weeds to destroy, and protection is afforded against the accumulation of snow, within the limits of the structures. On the other hand, in such areas as the Prairies, where curvature and gradient have a less pronounced effect and where tunnels are non-existent, considerably greater expense is incurred in restoring subsiding fills due to the less stable subgrades, repairing washout damage which results from the less well defined and inconsistent drainage patterns, control of vegetation which flourishes more freely, shimming of track due to greater frost disturbance, and maintenance of culverts and highway or road crossings which occur with much greater frequency than in the mountains."[1]

In 1908, the Canadian Pacific contended that "In the mountains the line was three times as costly to construct and almost twice as expensive to maintain and operate as on the Prairies. Bridges and trestles were more numerous in the mountains, tunnels and snow-sheds were necessary, and local traffic was light".[2]

In 1914, the Board of Railway Commissioners said that "beyond all question both the initial construction and railway operation through the mountains, are much more expensive than operations on the prairies".[3] The railways continued to hold this point of view until as late as 1948.[4] In view of this and in view of the fact that the Canadian National appear to hold this view at the present time, it would seem wise to accept that the effects of terrain are not balanced for the whole country until the development of a "comprehensive basis for adequately measuring all of the various effects of these features" has shown that the Canadian Pacific's current view is indeed correct.

The fact that in the Saunders' model the coefficient of yard and train switching miles jumps from $0.39 to $0.77 is sufficient indication that, with some sets of explanatory variables, the effect of introducing a measure of terrain variations does, in fact, cause differences in the coefficients.

One respect in which the explanatory equation presented by Banks differs from those presented by the other analysts is that it uses train-miles rather than gross ton-miles as the explanatory variable.

In the particular case of the grain trade this substitution is very important for if the appropriate variable is train-miles, and if, as has been claimed, grain travels in heavier trains than other goods generally (so that a ton-mile of grain represents fewer train-miles than a ton-mile of other commodities), the use of gross ton-miles inflates the cost of moving grain and deflates the cost of moving other commodities.

Train-miles were used on the ground that the wear and tear on track is related to the weight on the axles of the rolling stock passing over

[1] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22534-22535.

[2] Currie, A. W., *Economics of Canadian Transportation*, Toronto, University of Toronto Press, 2nd ed., 1959, p. 53, reporting Coast Cities Case (1908) 7 C.R.C. 125.

[3] *Ibid.*, p. 59, reporting Western Rates Case (1914) 17 C.R.C. 225.

[4] *Ibid.*, p. 105.

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the track, and that the unit with the heaviest axle-loading (the locomotive) controls the amount of wear and tear. This argument is appealing. In some places, regulations for trucks travelling on public highways restrict the axle-loadings, on the ground that heavier axle-loadings accelerate the breaking-up of the highways. It certainly seems reasonable to believe that there will be a greater maintenance cost with heavier axle-loadings.[1] Recently the Canadian Pacific shifted from steam to diesel locomotives. The axle-loadings of the diesel locomotives are higher, in three of the four classes used on branch lines, than were those of the steam locomotives.

TABLE I—CANADIAN PACIFIC RAILWAY STEAM AND DIESEL BRANCH LINE LOCOMOTIVE AXLE-LOADINGS

Steam		*Diesel*	
Class	*Weight per driving axle*	*Class*	*Weight per driving axle*
	(*lbs*)		(*lbs*)
D.10	52,000	DS.10	57,500
G. 5	50,667	DS.12	59,650
		DRS.106	45,250
		DRS.12	55,825

SOURCE: Letter, W. J. Stenason, Director of Economic Research, Canadian Pacific Railway, to D. H. Hay, May 6, 1961, Table 1.

According to the Canadian Pacific, this table shows "that the rail replacement program of Canadian Pacific has been associated with an increase in axle loadings".[2] It seems that there can be no dispute that heavy axle-loadings of locomotives cause track maintenance cost.

To jump from this conclusion, to the further conclusion that the miles travelled by locomotives as measured by train-miles should replace gross ton-miles as an explanatory variable is not, however, so simple. Even if it is true that the locomotive causes more maintenance than a single car, the movement of a number of cars may cause more maintenance than the locomotive which pulls them.

[1] New evidence on this point has recently been given by Mr. Donald Gordon, President of the Canadian National Railway.

"The CNR has some 4,500 miles of track laid with light rail which restricts the class of diesel power that can be operated by reason of axle loading . . . Because of the weight restrictions brought about by rail and bridge conditions, the CNR requires over 200 light axle road diesel units to handle traffic on these branch lines . . . The cost of upgrading these branch lines to make them fit for main line power is prohibitive (approximately averaging 30 to 50 thousand dollars per mile)." House of Commons, Sessional Committee on Railways, Airlines and Shipping, Proceedings and Evidence, No. 1, Thursday, June 15, 1961, p. 65.

[2] Stenason, W. J., letter to D. H. Hay, March 6, 1961. Note also the statement on page 22523 of the Transcript, "Canadian Pacific has been, and will be, faced for many years with the necessity of replacing considerable mileages of light rail, which is not yet worn out, owing to its inadequacy to withstand the heavier axle loadings which it is now required to accommodate".

One method of testing the effect of train-miles and gross ton-miles would be to use both in an explanatory equation. Unfortunately, there is a sufficient degree of collinearity between these on the Canadian Pacific that this approach is not satisfactory. However, in a number of models (to be discussed later) tested by the Commission staff train-miles were substituted for gross ton-miles. In each case, the explanation was slightly less satisfactory than when train-miles were used. In addition, some evidence is available from Canadian Pacific experience. On the main line of the Kenora division which is double-track, "train-miles in the eastward and westward division are approximately equal, but the gross ton-miles in the eastward direction are greater than in the westward direction. As can be seen from Table II, the average life of rail in the westward direction is 25.3 years as compared with an average life of 14.9 years for the rail in the eastward direction".[1] Until further evidence is received, gross ton-miles appear the better variable to explain road maintenance.

Finally, the Banks' explanation differs from others in the derivation of the $742.52 per mile of track in that it was not found through regression analysis. It was defended as reflecting "a magnitude acceptable on an engineering basis, using data publicly available from the Dominion Bureau of Statistics, as well as information supplied by the CPR Engineer of Track. This cost is our estimate of irreducible road maintenance and depreciation expense".[2] The phrase "irreducible road maintenance and depreciation expense", is an unfortunate one which was introduced by Canadian Pacific witnesses. The coefficient of approximately $1,150 per mile of track can be interpreted as the amount which the Canadian Pacific would spend on track which it was keeping fit for traffic, although no traffic was in fact moving over it. In defence of their figure, Canadian Pacific produced an engineering appraisal[3] which indicated that under these conditions, an expenditure of approximately $1,100 would be made.

The Banks' view, as expressed under cross-examination, was as follows:

> "It is our view that the deductions as to minimal maintenance that an engineer might make from a review of the Canadian Pacific maintenance of way rules would lead one to a higher standard of maintenance and to a greater expense for track maintenance than is actually required on a minimum irreducible track basis. And this is simply because Canadian Pacific, as a well run railroad, maintains its track more expensively and to a higher standard than some railroads which do not have the Canadian Pacific's financial resources."
>
> "Q. You mean by that that Canadian Pacific wastes money on its track?"
>
> "A. Oh, not at all. I am saying that what Canadian Pacific considers to be a deferred standard of maintenance is the normal operating routine

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[1] *Ibid.*

[2] Transcript of evidence, *Hearings*, November 10, 1960, Vol. 116, p. 19264.

[3] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22524.

of an engineer who does not know from one year to the next whether his budget is going to be $20,000.00 or $30,000.00."[1]

Thus, the figure produced by the Banks' organization was not presented as the expenditure which the Canadian Pacific made in fact, but as an estimate of what the expenditure might have been if the Canadian Pacific

TABLE II—AVERAGE LIFE OF RAIL IN MAIN LINE OF KENORA DIVISION (CPR)

Based on Age of Rail Last Removed

Age (Years)	*Westward Track*		*Eastward Track*	
	Miles	*Mile-years*	*Miles*	*Mile-years*
1	—	—	—	—
2	—	—	—	—
3	—	—	—	—
4	—	—	7.7	30.8
5	—	—	2.4	12.0
6	—	—	16.1	96.6
7	—	—	18.3	128.1
8	—	—	11.1	88.8
9	—	—	14.1	126.9
10	—	—	39.3	393.0
11	—	—	34.1	375.1
12	4.0	48.0	10.5	126.0
13	2.0	26.0	10.7	139.1
14	5.5	77.0	49.1	687.4
15	—	—	26.4	396.0
16	2.2	35.2	20.7	331.2
17	1.7	28.9	18.5	314.5
18	0.9	16.2	8.6	154.8
19	3.2	60.8	9.9	188.1
20	4.3	86.0	1.7	34.0
21	1.4	29.4	10.5	220.5
22	3.0	66.0	48.5	1,067.0
23	43.2	993.6	35.1	807.3
24	54.3	1,303.2	7.1	170.4
25	73.3	1,832.5	—	—
26	48.4	1,258.4	3.6	93.6
27	82.0	2,214.0	1.7	45.9
28	47.6	1,332.8	2.3	64.4
29	12.0	348.0	—	—
30	19.0	570.0	—	—
Total	408.0	10,326.0	408.0	6,091.5
Average age (years)		25.3		14.9

[1] Transcript of evidence, *Hearings*, January 16, 1961, Vol. 130, p. 22376.

had viewed its situation differently. If the Banks' argument were accepted, it would seem that $394.29 per mile of track (the difference between Banks' and Canadian Pacific estimates) would have to be charged to high maintenance standards. This course cannot be recommended. The regression approach seems preferable for our purposes.

The Saunders Co. presented fifteen explanatory equations of which one has been presented above. These were given in explaining the reasoning and testing which led to the presentation of two rather complex models as improved explanations of the track maintenance and depreciation expenditure. We need not present all these equations, but some comments upon the hypotheses which were being investigated might be in order.[1]

An initial attempt to separate the effects of freight from passenger gross ton-miles was abandoned when the results indicated that passenger ton-miles caused about thirty times the maintenance of freight ton-miles, and the coefficient for freight ton-miles proved to be not significantly different from zero—perhaps because of the close relationship between the two ($r=.90$).

A similar attempt was made to separate the effects of yard locomotive switching miles and road locomotive switching miles. Although statistically this produced a satisfactory explanation, the coefficient for road locomotive switching was too high to be accepted as realistic.

The effect of different types of track was examined by separating miles of track into miles of running track, main lines; miles of running track, branch lines; and miles of switching track. Then the effect of substituting miles of roadway for miles of track was examined. In each case, although interesting relationships were obtained, the models did not satisfy all the statistical tests.

Two models were developed which, it was felt, did not have statistical disabilities:

(5)	Expenditures=	$1,026,000	
		+$1,580 per main track-mile	(2.5)
		+$ 911 per branch track-mile	(4.4)
		+$0.126 per thousand gross ton-miles	(2.5)
		+$0.498 per yard locomotive-mile	(3.1)
	$R_2=.884$	+$3.749 per road locomotive-mile	(3.3)

and

(6)	Expenditures=	$778,000	
		+$1,092 per mile of roadway	(8.8)
		+$0.191 per thousand gross ton-miles	(8.8)
		+$0.585 per yard locomotive-mile	(4.1)
		+$3.830 per road locomotive-mile	(4.1)

[1] The full argument appears in Transcript of evidence, *Hearings*, November 11, 1960, Vol. 117, p. 19489-19506. The discussion from this point to the Canadian Pacific counter-argument is a summary of that presented by Saunders.

Following the examination of the effects of grades and curves which we discussed above (equation (4)), the Saunders Co. investigated the impact of grades and curves on the maintenance costs which are explained by variations in traffic. This was done by the application of an index of grades and curves, similar to that for track-mileage, but weighted in accordance with traffic densities.

Two further adjustments were made. The first of these was based on an opinion that passenger traffic caused (because of higher speed) twice as much wear and tear as freight traffic and that the standards of passenger traffic caused maintenance practices to be twice as costly as for freight services alone. The main body of their argument was as follows:

> "It seems self-evident that if a higher standard of structure and maintenance are established on a line because passenger trains must operate over it at passenger train speed, comfort and safety, then the freight trains that also use the tracks contribute to the wearing out and tearing down of that higher standard. The higher cost of the wear-and-tear of the freight trains on this passenger-standard line, in excess of what their cost would have been over a lower freight-only line is clearly chargeable to the passenger service.
>
> "The CPR system in 1958 produced about six billion freight gross ton-miles and about one billion passenger gross ton-miles. Thus, if passenger gross ton-miles had had exactly the same cost as freight gross ton-miles, passenger trains would have accounted for one billion out of a total of seven billion freight equivalent gross ton-miles. But with passenger gross ton-miles having a wear-and-tear equivalent of two freight gross ton-miles, the passenger service would have been chargeable with two billion out of a total of eight billion *freight equivalent* gross ton-miles, if all lines had been maintained to freight-only standards.
>
> "Actually, virtually all the passenger gross ton-miles and part of the freight gross ton-miles took place over lines maintained to passenger standards, which can be assumed to double the cost. Supposing that at least one-third of the freight gross ton-miles were on passenger lines, then four of the above eight billion total really represented eight billion freight equivalent gross ton-miles on passenger-standard lines, which, together with the remaining four billion gross ton-miles on freight-only lines, brings the total to twelve billion freight equivalent gross ton-miles. Of course, the actual six billion freight gross ton-miles can only be charged with six of these twelve billion. As a result, we can conclude that under these assumptions, the one billion actual passenger gross ton-miles on the CPR in 1958 were equivalent to six billion freight gross ton-miles. Thus it appears that a ratio of six-to-one would more nearly reflect the freight equivalence of passenger gross ton-miles than the ratio of two-to-one used by the CPR. If the fraction of gross ton-miles taking place over passenger lines is actually one-half or two-thirds, the ratio would increase to seven- or eight-to-one."[1]

The Canadian Pacific attacked both bases of this contention. With regard to the relative effects of speed they said:

> "To reflect the relative effects of passenger and freight traffic on maintenance-of-way expenses, the American Railway Engineering Associa-

[1] Transcript of evidence, *Hearings*, November 11, 1960, Vol. 117, p. 19504-19505.

tion employs equating factors of 1.0 for freight or passenger car gross ton miles, 2.0 for freight locomotive gross ton miles and 3.0 for passenger locomotive gross ton miles. Applying these equating factors to 1956, 1957 and 1958 traffic on Canadian Pacific lines, equivalent passenger gross ton miles amounted to 64.04 billion and equivalent freight gross ton miles amounted to 233.67 billion. Actual gross ton miles for passenger cars, as used in the grain cost study, were 32.64 billion and for freight cars and contents were 183.59 billion. The ratio of equivalent to actual gross ton miles, therefore amounted to 1.962 for passenger traffic and 1.273 for freight traffic. On this basis, the relative effect of passenger to freight gross ton miles would be 1.962 divided by 1.273, equalling 1.54, which is somewhat less than the factor of 2.0 used by Canadian Pacific but only about one-quarter of the factor of 6.0 suggested by the cost consultant for the Grain Handling Organizations.

"The equating factors employed by the American Railway Engineering Association were developed by representatives of major railways throughout Canada and the United States on the basis of their extensive practical experience in roadway maintenance. As pointed out by Professor W. W. Hay on page 29, Volume I, of his book entitled "Railroad Engineering" when referring to these equating factors, "the equating factors have been derived for steam locomotives whose reciprocating motion at high speeds is hard on the track. Where diesel-electrics or straight electrics with rotative drive are used, there may be justification for using values less than those given above". Since Canadian Pacific was largely dieselized during the cost study, a weighting factor of 2.0 is, if anything more than adequate. This appraisal of the weighting factor is substantiated by supervisory officers in direct charge of track maintenance on Canadian Pacific based on their experience."[1]

With regard to the effects of a higher standard of maintenance they said:

"Although some lines on Canadian Pacific are maintained in somewhat better surface and alignment than might be required for freight service alone, owing to the higher operating speeds of passenger trains using them, there are no higher standards of construction for lines carrying a substantial volume of passenger traffic than those which carry freight traffic exclusively. There is no difference in the size of rail or in the quantity or quality of ties and ballast used for freight service and for passenger service. Some lines which have light or moderate curvature and which carry passenger traffic have curves super-elevated somewhat in excess of that required for freight train speed in order to permit passenger trains to operate at higher speed. In heavy curve territory, however, where the effect of curvature on track maintenance is most pronounced, it is the practice of Canadian Pacific to limit the speed of passenger trains to the same as that authorized for freight trains. Accordingly, there is no appreciable amount of additional cost resulting from "higher standards of track structure" and any additional maintenance cost incurred in the preservation of better surface and alignment to provide satisfactory riding qualities for passenger equipment would be considerably less than double that required for freight train operation.

"There is no evidence to support the hypothesis that freight trains produce more wear and tear on tracks maintained for passenger traffic than on tracks maintained for freight traffic alone. There are no circumstances which would lead to such a result except, possibly, in the case of curves

[1] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22532-22533.

> super-elevated in excess of freight train speed requirements which, as mentioned previously, is only applicable on Canadian Pacific where light or moderate curvature prevails. In fact, experience indicates that track deteriorates at an accelerating rate as the deterioration progresses so that it would be reasonable to expect that, on the contrary, freight traffic would incur less track maintenance expense on a line maintained for passenger traffic than on a lower standard freight line."[1]

In the models which the Saunders organization used, when freight and passenger gross ton-miles were introduced as separate variables, the resulting coefficients indicated a greater ratio than two-to-one. But as they, themselves, said, "Because of the high intercorrelation between passenger and freight gross ton miles, the multiple regression technique cannot be used to test this assumption or to derive the true ratio".[2] Further, when a six-to-one ratio was substituted in two of the Saunders' models, there was, from a statistical point of view, little improvement in one case and no improvement in the other.

In the face of the evidence that a six-to-one ratio is far from the value traditionally accepted and that it does not accord with what railway operating officials of the Canadian Pacific believe reasonable from their experience, it is difficult to accept the six-to-one ratio without firmer statistical backing. At the same time, it must be noted that what statistical evidence there is, is all in the direction of suggesting a ratio higher than two-to-one. It is to be hoped that if a situation arises, on either the Canadian Pacific or the Canadian National, when the high intercorrelation between freight and passenger gross ton-miles no longer exists, the railways will seize the opportunity for further statistical testing.

The last modification instituted by the Saunders' organization was to combine several sets of variables in one of their equations. Each of main track-miles, branch track-miles and gross ton-miles was combined with its counterpart attached to the grade and curve index. Thus part of one equation read:

$$527\,X_1 + 617\,X_1\,(X_{11} - 100),$$

where X_1 represents main track-miles and X_{11} represents the main track index. Dividing by 527 one finds the new composite variable

$$(X_1 + 1.170\,X_1\,[X_{11} - 100])$$

The three combined variables,

$$\begin{aligned}
&\text{main track-miles variable} = X_1 + 1.170\,X_1\,(X_{11} - 100)\\
&\text{branch track-miles variable} = X_2 + .146\,X_2\,(X_{12} - 100)\\
&\text{gross ton-mile variable} = X_3 + .539\,X_3\,(X_{13} - 100),
\end{aligned}$$

[1] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22531-22532.
[2] Transcript of evidence, *Hearings*, November 11, 1960, Vol. 117, p. 19504.

were substituted for separate variables in a previous equation.[1] This was done in an attempt to strengthen the "t" values of the previous equation. It was pointed out that because this substitutes coefficients already estimated from the data in the form of predetermined relationships the new "t" values are not susceptible to evaluation.

An interesting line of argument was introduced in this excerpt:

> "In certain of Mr. Saunders' track expense regressions, main line track miles and branch line track miles have been introduced as separate independent variables and independent coefficients of expense developed. There is no consistency in the various relationships between these coefficients: the coefficient for main lines is more than double that for branch lines in Equation 4,[2] is 73% greater in Equation 6 and less in Equations 11, 12 and 14 except on territories with relatively low tonnage ratings. This indicates that these coefficients may be absorbing some of the influences of traffic volume. Such a result can be expected in view of the fact that the distinction between main lines and branch lines is primarily a function of traffic density. Since a realistic coefficient of expense per mile of track should be free of any influences of traffic volume and the functions which it represents are just as much a reality on branch lines as on main lines, there is no justification for any difference existing between the coefficients for main lines and branch lines.
>
> "The breakdown of track miles into main line and branch line miles distorts the equation as the main line track variable absorbs costs which are truly chargeable to gross ton-miles. This is the result of the high intercorrelation between miles of main line track and gross ton miles . . . Canadian Pacific has tested this by developing a regression in which the minimum maintenance cost of $1,137 per mile of track has been deducted from the dependent variable, and miles of main line track added as an explanatory variable. The purpose of such a test is to determine whether miles of main line track add a significant factor to the regression or whether their effects is merely to distort the gross ton mile coefficient. It was seen that the latter is true, for the effect of introducing miles of main line track as an independent variable was to sharply reduce the value of the gross ton-mile coefficient."[3]

Empirically, this may be true for the Canadian Pacific. Its truth depends upon the high correlation between main track-miles and gross ton-miles. Even though main track is defined on the basis of traffic density, it is not necessary that main track-miles and gross ton-miles be highly correlated. A high traffic volume can exist in a division with either (a) a small number of high-density lines, or (b) a large number of low-density lines. Since the high correlation exists, the proportion of high- and low-density miles per division must be roughly constant. One might imagine a railway defining main track-miles as those having a traffic density of 300,000 gross ton-miles per mile or over. (The low figures of this example were chosen for ease in calculation.) Two divisions on this railway might then have the following track and traffic.

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[1] Subscripts altered from original.

[2] Equation numbers refer to original Saunders & Co., submission and not to those of this report.

[3] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22527-22528.

TABLE III—TRAFFIC DENSITY OF TWO HYPOTHETICAL DIVISIONS

	Miles	*Ton-miles (millions)*	*Density (hundred thousand gross ton-miles per mile)*
Division A	700	70	1
	300	150	5
Total	1,000	220	2.2
Division B	500	50	1
	500	170	3.4
Total	1,000	220	2.2

The explaining equation of the railway would treat these divisions as identical. The Saunders' equations discriminate between the two cases. Since the wear and tear caused by traffic depends upon the density on the particular segment of track rather than on the average density in the division, the Saunders' equations are a more precise formulation.

More interesting is the logical conclusion of this argument which is that, as far as running track is concerned, miles of roadway should be the relevant explanatory variable rather than miles of track. Passing sidings are added only to accommodate increases in traffic and, *a fortiori*, second track is a reflection of a high ton-mileage. Following the argument of the last quotation, one can contend that the use of miles of track, rather than miles of road, fails to remove important influences of traffic volume.

The Saunders Co. presented equations which utilized the miles of roadway. One of these was:

(7) Expenditures = −$32,000			
	+$809	per mile of roadway	(2.7)
	+$253	(miles of roadway) (grade index −100)	(1.7)
	+$0.119	per gross ton-mile	(3.5)
	+$0.066	(gross ton-miles) (grade index −100)	(2.8)
$R^2 = .945$	+$0.769	yard locomotive-miles	(5.7)
	+$3.307	road locomotive switching miles	(4.2)

In view of the prominence which the treatment of this group of accounts had received, and in view of the complexity of the relationships between these accounts and the output variables, special attention was paid to this analysis by the Commission staff. As a first step, the expenditures by division were examined when plotted on graph paper against the estimated expenditures for each of the divisions. The residual amounts, unexplained by the estimates of the railway and by several of the consultants' models,

were examined. It was suspected that the Vancouver division had characteristics differing from other divisions. "Examination of the dependent variable input data to Account 202, etc.," by the Canadian Pacific on request, "for the Vancouver Division shows amounts for the years 1957 and 1958 of $1,739,985 for extensive bridge work over that required in 1956."[1] This amount was removed from the accounts since both the statistical evidence and conversations with railway officials indicated that this was an expenditure of a different nature than occurred on other divisions. The treatment of this amount is discussed below.

The net relationships were then plotted, that is, for each division the effects (according to equation (1)) of gross ton-miles, and of yard and train switching miles, were subtracted from the actual expenditure. The remaining amounts can be attributed to miles of track and random effects. These net amounts were plotted against miles of track. Similarly the net amounts attributable to gross ton-miles and to yard and train switching miles were plotted against the appropriate output variables. Inspection of these various graphs indicated the possibility that at least one of the relationships was not linear.

Two possibilities suggested themselves. The first was that the relationship between expenditures and miles of track is either of the classic shape discussed on page 203 of Chapter 2 or a second degree approximation to this. (That is that it can be expressed as either $E = a - bX^2 + cX^3$ or as $E = a - bX^2$.) The second was that the relationship between expenditures and gross ton-miles is curvilinear. This latter idea was suggested by earlier findings in the United States. For example, Healy, studying the maintenance-of-way expenses of Class I railroads in the United States in 1927 and 1935 remarks:

> "In both cases there is a definite tendency for expense per mile of road to start at a certain minimum and increase consistently as density increases. The existence of a minimum, below which standards cannot drop, results in a rather high unit expense at the very lowest density, but by the time the range of density at which most railroads operate is reached, a relatively uniform unit expense is maintained. At the average density for the country, which was 4,000,000 gross ton-miles per mile of road, the expense is 0.04 cents per gross ton-mile. For double that density it drops only to 0.036 cents. The same trend is evident when density is expressed in terms of car-miles. At a density of 50,000 car-miles per mile of road per year, below which few Class I railroads operated in 1935, the maintenance-of-way expenses were 2 cents a car-mile. At double that density, which is approximately the average density for the Class I railroads, the unit expenses become 1¾ cents. Doubling the density again brings it to a level exceeded by only a few of the coal carrying roads, but the expense per car-mile drops only to 1½ cents."[2]

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[1] Letter, W. J. Stenason to D. H. Hay, Jan. 3, 1961.

[2] Healy, K. T.: *The Economics of Transportation in America*, New York, The Ronald Press, 1940.

Elimination of the exceptional (in the sense that it applied to but one division) expenditure in the Vancouver division raised the general fit of the estimating equation, as measured by the coefficient of determination, R^2, from 83 per cent to 86 per cent. The attempt to fit a curved line to the relationship between miles of track and expenditures showed a similar improvement, a second degree equation raised R^2 to .90, a third degree to .92. In both cases linear relationships were preserved for gross ton-miles and for yard and train switching miles.

In an attempt to represent the apparent curvature of the relationship between gross ton-miles and expenditures, the logarithms of gross ton-miles were substituted for the original values while miles of track and yard and train switching miles were treated in the original fashion. The result was a drop in the amount of variance explained, R^2 went down to .80.

Examination of the working papers of W. B. Saunders and Co. confirmed the suggestion of Mr. Saunders that more needs to be known about the switching function.[1] In certain formulations, the four Canadian Pacific terminal divisions appeared to act as a group with different characteristics than the twenty-seven line-haul divisions. To test this, the Canadian Pacific ran a special model in which it was assumed that switching miles have a different character on line-haul divisions than they do on terminal divisions. Switching miles were split into two variables, the first having the number of switching miles for line-haul divisions, and zero entries in the case of terminal divisions, the second having zero entries for the line-haul divisions and the switching miles for terminal divisions. The results of this test were an indication of an appreciable but apparently not statistically significant difference between the coefficients of the switching variable for the two types of division.

A second problem which emerged from this examination was that although the variation in expenses was fairly well explained in general, in the case of certain divisions the discrepancy between the actual expenditures and those which would be estimated by the use of the equation was disconcertingly large. The estimated values for a number of divisions varied from the actual by from twenty to twenty-five per cent of the actual. In view of this it seemed wise to search for a new explanation which, even if it did little to improve the general fit, would lessen these large discrepancies. While plotting the graphs of the net effects for this stage of the analysis, it was noticed that the Kenora division was greatly over-estimated by the mile-of-track variable. Since this division has a great deal of double-track line, the hypothesis that the appropriate variable is miles of road, rather than miles of track, was again considered. Substitution of this variable raised the R^2

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[1] Transcript of evidence, *Hearings*, January 10, 1961, Vol. 128, p. 22125-22126.

to .93. More important, it succeeded in reducing some of the large discrepancies.

Again, an attempt was made to solve the problem of the switching variables. Yard engine switching miles have a very high correlation with yard track-miles. This is to be expected since the size of yard can be adjusted (given time) to the amount of switching which is taking place. On the other hand, the tracks which are switched exclusively by road locomotives (the definition of road switching track), will often be little used, in comparison with yard track. It may exist primarily to give access to particular industries. It seemed possible that yard locomotive switching miles might be used as a variable explaining both the maintenance caused by yard switching, and that attached to the existence of yard switching track. Road switching miles and yard switching miles might then be used as separate variables. Neither this formulation nor any of the variations tried were successful in giving a better explanation of this account. At the present time it seems that the best explanation is given by using yard and train switching miles as a variable to explain both the maintenance costs associated (in fact) with the actual switching operation and those associated (in fact) with the existence of switching track.

Plotting the net expenditures against the explanatory variables again raised the question of curvilinearity. The introduction of a second degree term for gross ton-miles raised the coefficient of determination to .94, but more important was the fact that this improvement was largely due to a lessening of the larger discrepancies. In particular the estimate for the Kenora division, which consistently had estimated expenditures far over those actually experienced, was brought closer to experience. Equation 8 presents the results of this step.

$$
\begin{array}{llll}
(8) & \text{Expenditures} = & -\$55{,}533 & \\
& & +\$3{,}558.0 \text{ per mile of road} & (.593) \\
& & -\$3.6492 \text{ per (mile of road)}^2 & (-.469) \\
& & +\$0.015604 \text{ per (mile of road)}^3 & (.439) \\
& & +\$0.28217 \text{ per thousand gross ton-miles} & (.695) \\
& & -\$0.000{,}000{,}013059 \text{ per (thousand gross ton-miles)}^2 & (-.417) \\
& R^2 = .942 & +\$0.70262 \text{ per yard and train switching mile} & (.677)
\end{array}
$$

NOTE: For both equations (8) and (9) the figures to the right in parentheses are partial coefficients of correlation and not "t" values.[1]

[1] The electronic computer programme available to the Commission staff did not include a provision for the computation of "t" values. The expense of including such a provision did not appear justified.

Finally, the residuals were compared with a new composite variable, miles of road multiplied by Saunders' index of grade and curvature (weighted by mileage). One hundred was subtracted from the original index in each case. This examination indicated a strong possibility that a relationship between terrain, as measured by this index, and expenditures on maintenance-of-way existed in sufficient degree to warrant the insertion of this variable in the explanatory system. This was the final adjustment made in the statistical model. This model was as follows:

(9)	Expenditures $=$	\$27,059.80	
		$+$\$1,288.1 per mile of road	(.223)
		$-$\$1.5140 per (mile of road)^2	(—.214)
		$+$\$0.0090402 per (mile of road)^3	(.292)
		$+$\$0.32000 per thousand gross ton-miles	(.777)
		$-$\$0.000,000,013338 per (thousand gross ton-miles)^2	(—.479)
		$+$\$0.69143 per yard and train switching mile	(.725)
	$R^2 = .957$	$+$\$4,6334 per mile of road times Saunders' grade index	(.511)

It is interesting to note that the effect of introducing this new variable was to reduce the coefficients for miles of road to about half their previous values, while similarly lowering the explanatory power of these values. This suggests that a future programme of research might include an investigation of the weighting of miles of road and the grade index.

The coefficients for gross ton-miles and for yard and train switching miles remained stable when the new variable was added.

Despite lack of complete satisfaction with the strength of the miles-of-road coefficients, equation (9) has been accepted for this report.

The most satisfactory treatment, presently available, of the amount of \$1,739,985 deducted from the road maintenance accounts of the Vancouver division, appears to be to treat it as an expenditure caused by events for which some contingency allowance must be made. The amount can be prorated to the miles of road in the system as an allowance for unusual, recurrent expenditures.

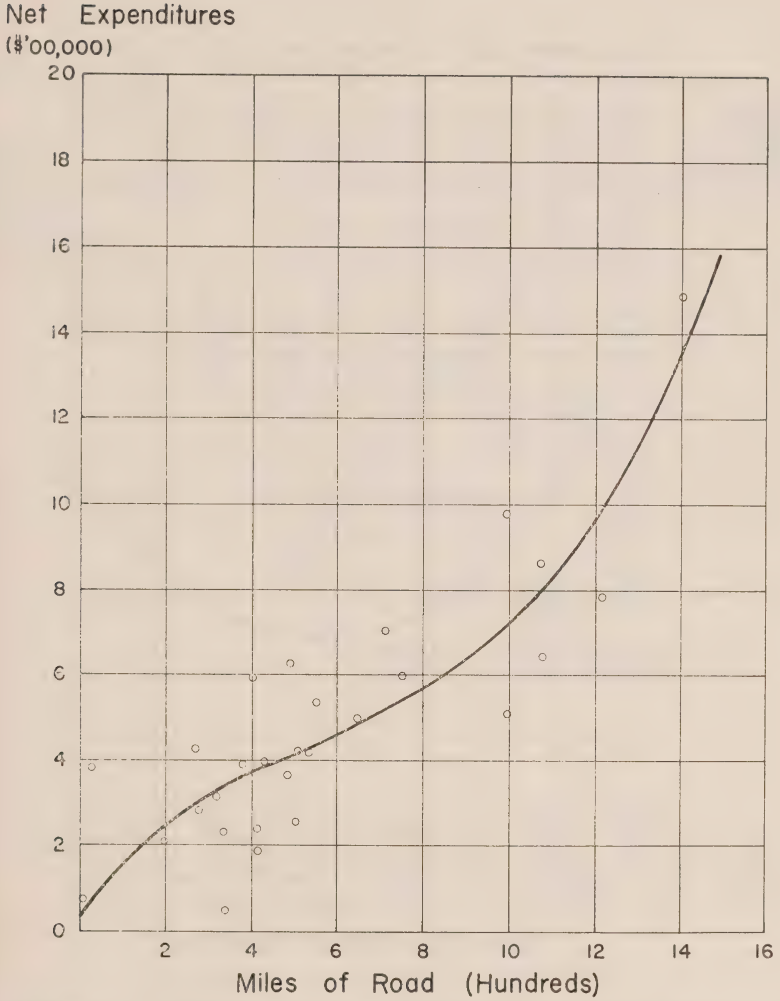

FIGURE 1: Relationship between Road Maintenance Expenses and Miles of Road for Canadian Pacific Railway after Allowance for Effect of other Variables. Based on Equation 9.

53744-9—17

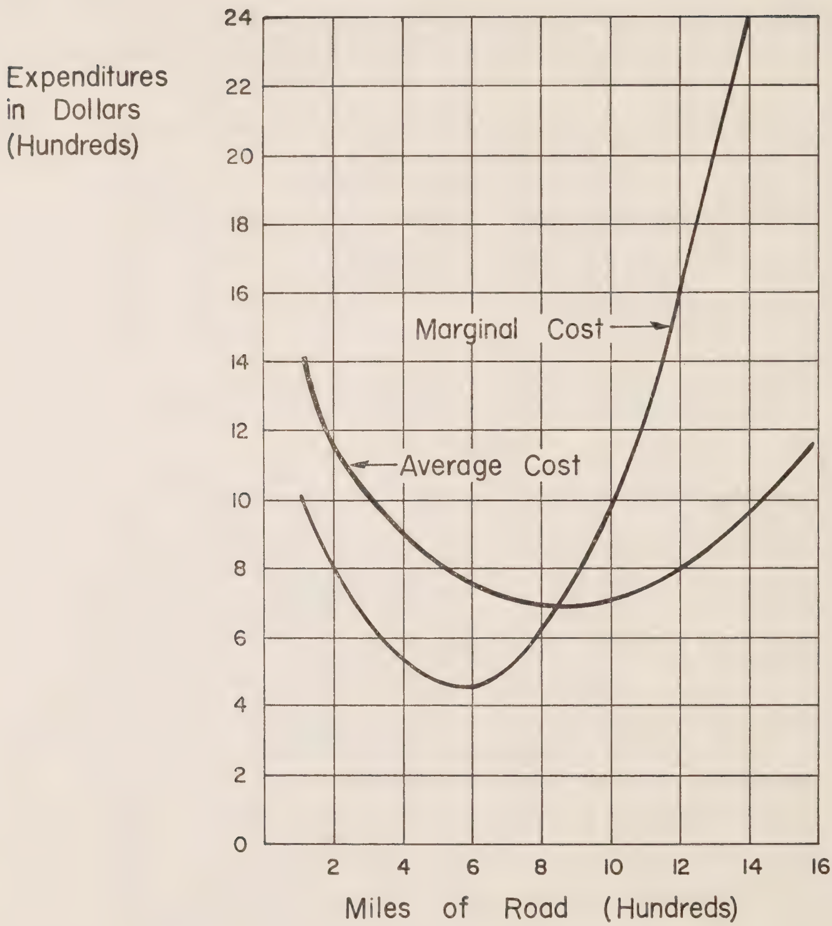

FIGURE 2: Average and Marginal Costs related to miles of road for Canadian Pacific Railway according to Equation 9.

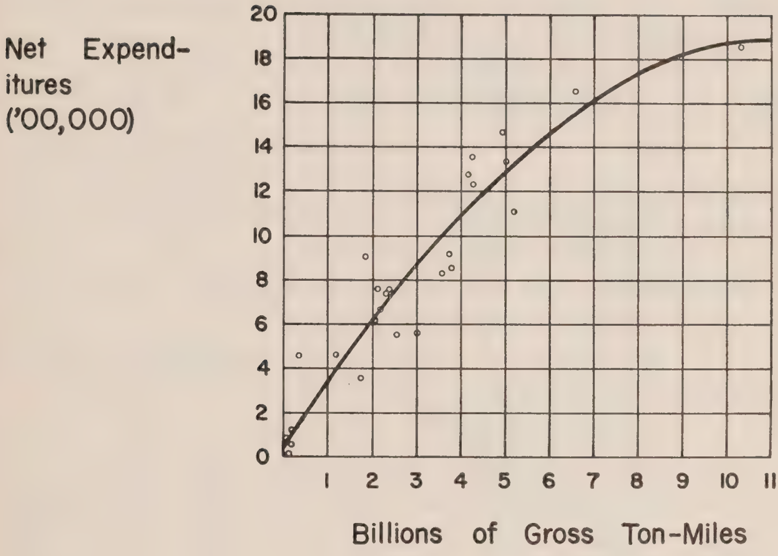

FIGURE 3: Relationship between Road Maintenance Expenses and Miles of Road for Canadian Pacific Railway after allowance for effect of other variables.
Based on Equation 9.

53744-9—17½

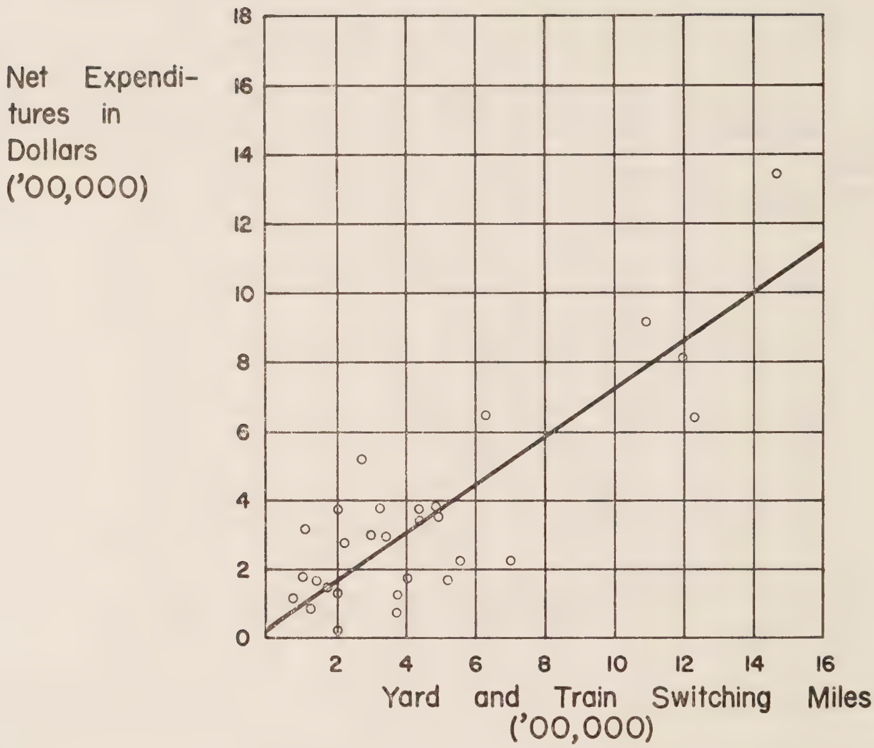

FIGURE 4: Relationship between Expenditures on Road Maintenance and Yard and Train Switching Miles for the Canadian Pacific Railway after allowance for the effect of other variables.

Based on Equation 9.

2. *Road Maintenance Superintendence and Overhead*

CANADIAN PACIFIC RAILWAY

Accounts Explained 201 Superintendence (Road Maintenance)
274 Injuries to Persons (Road Maintenance)
276 Stationery (Road Maintenance)
277 Other Expenses (Road Maintenance)

(10) Expenditures= \$1,083,445
+\$0.032888 per direct road maintenance expense (t=5.26)
R^2=.78 +\$43,92223 per mile of track (3.62)

CANADIAN NATIONAL RAILWAYS

Accounts Explained 201 Superintendence (Road Maintenance)
274 Injuries to Persons (Road Maintenance)
276 Stationery (Road Maintenance)
277 Other Expenses (Road Maintenance)
275 Insurance (Road Maintenance)

(11) Expenditures= \$65,318.66
R^2=.58 +\$0.060,005 per dollar direct road maintenance expense (6.17)

Both railways, it will be seen, explained at least part of the variation in superintendence and overhead expenses by relating these indirect expenses to the direct expenses. In order to relate these accounts to the output units, the amounts of expense attributed to the study traffic in each of the other road property maintenance accounts were multiplied by the coefficient for dollars of direct road maintenance expense in the equations above. An equivalent procedure would have been to multiply the coefficients of equation (10) or (11) by the relevant coefficients found in the analyses of the other road property maintenance accounts, then multiply the product by the appropriate output units assessed to the study traffic.[1]

Thus, with reference to the road maintenance accounts,[2] the explanation for the variable costs of superintendence might have been written:

(12) Expenditures= (\$1,136.81110)(0.03288) per mile of track
+\$43,92223 per mile of track
+(\$0.16475)(0.03288) per thousand gross ton-miles
+(\$0.39053)(0.03288) per yard and train switching mile

[1] Symbolically, Σ a(bc) is equivalent to Σ (ab)c.

[2] For illustrative purposes, equation (1), that is, the explanation of road maintenance expense suggested by the Canadian Pacific, has been selected for combination with equation (10).

Simplified, equation (12) would read:

(13) Expenditures = \$81.30058 per mile of track
+\$0.0054170 per thousand gross ton-miles
+\$0.012841 per yard and train switching mile

Following a similar procedure with each of the other groups of accounts studies for road maintenance, the similar terms could have been added together to give a single explanatory equation for road maintenance superintendence and overhead. Algebraically the methods are identical, only the order of the operations performed is different.

The method of the last two paragraphs is a complicated example of a procedure which was entitled by the cost analysts, who appeared before the Commission, "pyramiding". It was generally agreed that this is not the best procedure. Among the comments made about pyramiding were the following: "It is of little value to introduce a variable which cannot be directly related to a particular cost category by the use of an intermediary variable. Most likely the improved statistical results (if in fact there is an improvement) is not due to underlying relationships but to statistical mechanics." ". . . no method is readily available of testing the statistical significance of the coefficients in the final cost equation derived."[1]

The arguments of the last paragraph suggest that one should try to relate this group of accounts directly to the output variables. Since superintendence is one of the areas in which non-linearity, of the type discussed in connection with the track maintenance group of accounts, can be expected, an attempt was made to estimate the relationships directly using a non-linear system. For Account 201, etc., on the Canadian Pacific, the following equation was obtained and has been utilized in this report:

(14)	Expenditures = (Acct. 201, etc.)	−\$9,493.5	
		+\$3867. (miles of road)	(.651)
		−\$0.44167 (miles of road)^2	(−.531)
		+\$0.00018548 (miles of road)^3	(.482)
	R^2=.833	+\$0.0064720 (thousand gross ton-miles)	(.528)
		+\$0.052843 (yard and train switching miles)	(.582)

NOTE: For this equation the parenthesized values to the right are the partial coefficients of correlation and not "t" values.

[1] Transcript of evidence, *Hearings,* January 23, 1961, Vol. 132, p. 22545-22546. During the hearings, these arguments were advanced to counter a suggestion that higher "t" values obtained by pyramiding were meaningfully improved. In the present context, the last sentence quoted retains the full force it had in the original comment.

3. *Shops and Enginehouses, Maintenance and Depreciation*

CANADIAN PACIFIC RAILWAY

Accounts Explained 235 Shops and Enginehouses Maintenance
266 Depreciation

(15) Expenditures=	$81,200		(0.23)
	+$0.05230	direct equipment maintenance	
R^2=.91		expense	(9.13)

CANADIAN NATIONAL RAILWAYS

Accounts Explained 235 Shops and Enginehouses Maintenance

(16) Expenditures=	$73,582		
	+$0.040388	direct equipment maintenance	
R^2=.96		expense	(477.88)

Again, the railways chose an explanation which depends upon "pyramiding". R. L. Banks and Associates suggested a second explanation which also depends upon pyramiding. Rather than relate these expenditures to equipment maintenance expense, they chose to investigate the relationship between maintenance expense and the size of the shops and enginehouses as measured by the amount of investment in these facilities. Presumably expense in this category is explained by a causal chain of the following type: work (measured in gross ton-miles and yard and train switching) causes a need for maintenance; maintenance work causes a need for shops and enginehouses (measured by investment in these buildings); shops and enginehouses need maintenance both because of wear and tear caused by the work done in them and because of the action of the elements.

The railways chose to jump to the amount of maintenance work done. R. L. Banks and Associates chose to move to the size of shops and enginehouses. In doing this, Banks estimated the following relationships for eastern and western line-haul divisions:

West

(17) Expenditures=	$5,436.40		(0.09)
	+$0.05815	per dollar investment	
R^2=.89		in shops and enginehouses	(10.11)

East

(18) Expenditures=	$17,271.00		(0.49)
	+$0.06763	per dollar investment	
R^2=.92		in shops and enginehouses	(10.50)

Following this, the relationship between investment in shops and enginehouses and output units was estimated for the system.

(19) Investment,
Shops and
Enginehouses= $657,100.00 (0.32)
R^2=.26 +$1.7643 per yard and train switching mile (4.09)

Equation (19) was then substituted into equations (17) and (18) to yield the following:

West

(20) Expenditures= $43,646.00
+$0.10259 per yard and train switching mile

East

(21) Expenditures= $61,711.00
+$0.11932 per yard and train switching mile

The Canadian Pacific pointed out that had these relationships been estimated directly for the 17 western divisions (15 line haul plus two terminals) the following equation would have resulted:[1]

(22) Expenditures=—$67,600 (—1.031)
R^2=.65 +$0.22343 per yard and train switching mile (5.293)

R. L. Banks and Associates replied that a direct estimation using the 15 line-haul divisions resulted in a coefficient of determination of .40 and a regression coefficient of $0.13966 for yard and train switching miles. The differences in these coefficients from those of the Canadian Pacific direct model, and the existence of a negative constant value in the latter were cited as evidence of heterogeneity caused by differences between line-haul and terminal divisions.[2]

None of the explanations put forward to explain these accounts can be accepted as completely satisfactory. On *a priori* grounds there appears to be no basis on which to choose between direct equipment maintenance expense and investment in shops and enginehouses. The investment variable has the disadvantage that prices of different time periods are included. The direct expense variable has the disadvantage that it reflects current activity but will not reflect the possible necessity of maintaining shops or enginehouses built for another level of activity. From the point of view of statistical measures, the coefficient of determination and the significance of the regression coefficients, there is little to choose between them.

[1] Memorandum: W. J. Stenason to D. H. Hay, November 29, 1960.
[2] Letter: R. L. Banks to D. H. Hay, December 23, 1960.

Improvement in the explanation of these expenditures is likely to come only from an examination of the direct estimates. For that reason, they are chosen in this report. Furthermore, because it is based on a slightly more complete sample, the 17 observation sample will be used. It is quite true that the shifts in coefficients indicate that further study is needed. It is also true that these shifts may be due to heterogeneity—but they may be due to incomplete specification. Perhaps another explanatory variable would remove these peculiarities. As well, it would be desirable to use a method of estimation using information from the whole system. For the purpose of this report, equation (22) has been accepted as the explanation for Accounts 235-266 for the Canadian Pacific, since it appears to give the best explanation presently available. In doing so the need for further exploration must be explicitly recognized.

4. *Power Plants, Maintenance and Depreciation*

CANADIAN PACIFIC RAILWAY

Accounts Explained 253 Power Plant Systems
266 Depreciation

(23) Expenditures= \$0.01546 per dollar expense Account 373 (9.04)
$R^2=.74$

The Canadian National treated this account as part of the fixed cost.

R. L. Banks and Associates examined the relationships between expenditures in this account and output units for the east and west separately. In the west they found that expenditures on maintenance and depreciation of power plants is significantly related to investment in power plants. In the east this relationship was not significant but that with dispatching and station employees expenses (Accounts 372-3-6) was significant. They, therefore, developed two explanatory equations.

West

(24) Expenditures= \$4,189.19 (0.32)
$R^2=.80$ +\$0.08702 per dollar investment in power plants (7.17)

East

(25) Expenditures= \$7,983.82
$R^2=.50$ +\$0.008413 per dollar expenditure dispatching and station employees (3.15)

These equations were, in turn, related to output units by other equations.

The necessity to turn to different explanations in the east and west suggests that the best explanation of this account has not yet been found. It is difficult to believe that the cause of this expenditure is different in east and west. This account also needs further work in order to develop a direct relationship. In the meantime the Canadian Pacific model has been accepted for this report.

5. *Dispatching and Station Employees Expenses*

CANADIAN PACIFIC RAILWAY

Accounts Explained 372 Dispatching
373 Station Employees
376 Station Expenses

(26)	Expenditures=	\$6,666,613	(1.22)
		+\$5,6149 cars C.L. originated	(1.53)
		+\$0,02336 passenger car-miles	(1.63)
	R^2=.54	+\$65.35356 cars L.C.L. originated	(3.97)

The Canadian National dealt with Accounts 373 and 376 only. Account 372 was included with another group dealing with train control.

(27)	Expenditures=	\$367,814.6	
		+\$52,053 carloads L.C.L.	(4.0)
	R^2=.64	+\$4,2352 carloads, other	(1.4)

Because of the low "t" values, R. L. Banks and Associates chose to relate these accounts to other output variables.

(28)	Expenditures=	\$439,862	(0.71)
		+\$0.2839 per dollar investment in station and office buildings	(6.35)
	R^2=.79	+\$58.72 per car loaded L.C.L.	(5.46)

In turn, investment in station and office buildings was related to output units through the following equation:

(29)	Investment in station and office buildings=	\$2,766.771	(1.02)
	and	+\$0.19879 per thousand gross ton-miles (1 frt. + 2 passengers)	(2.52)

Substituting equation (29) into equation (28), the following explanation resulted:

(30)	Expenditures=	\$1,225,348
		+\$58.72 per carload L.C.L.
		+\$0.05644 per thousand gross ton-miles

In this case, the direct approach of the railways is clearly preferable to the "pyramiding" method. True, the "t" values are low, suggesting that the relationships are weak. Possibly this is because of the nature of the data available for analysis. For freight, only origination data has been used. For passenger traffic only passenger car-miles. On the face of it, these would not seem likely to be the best explanatory variables. While a part of the work of station employees is concerned with originating freight movements, part must be connected with freight terminations. For originations, a count of waybills issued would seem a likely candidate for an explanatory variable. Similarly, a count of shipments terminated would seem a likely explanatory variable. Passenger tickets sold might well account for both originations and destinations since in the case of passenger traffic these are likely to be roughly in balance. The data for these variables was not available at the time of these studies; we must rest content with equation (26) as a starting point in this analysis.

6. *Train Locomotive Supplies and Enginehouse Expenses*

CANADIAN PACIFIC RAILWAY

Accounts Explained 398 Train Locomotive and Supplies
400 Train Enginehouse Expenses

(31)	Expenditures=	\$161,051	
		+\$0.2124 per locomotive-mile (steam)	(1.94)
	$R^2=.571$	+\$0.12959 per locomotive-mile (diesel)	(1.87)

CANADIAN NATIONAL RAILWAYS

Accounts Explained 398 Train Locomotive and Supplies
400 Train Enginehouse Expenses

(32)	Expenditures=	\$376,190	
		+\$0.35094 per yard locomotive-mile	(11.83)
	$R^2=.89$	+\$0.05169 per train locomotive-mile	(2.2266)

R. L. Banks and Associates noticed when examining the scatter diagram for this account that the Quebec district obviously has a relationship between expenditures and output units which is not typical of the other districts. To correct this, they performed their analysis on the remaining nine districts. In addition, they dealt with all locomotive-miles taken together. This yielded the equation for the Canadian Pacific.

(33)	Expenditures=	\$726,630	(0.42)
	$R^2=.82$	+\$0.13410 (per locomotive-mile)	
		(steam and diesel)	(5.61)

On re-examination, the Canadian Pacific agreed that the Quebec district had an unusual relationship. An investigation of the process by which these accounts and output units are charged, showed that the locomotive-miles for trans-continental passenger trains are charged to the various districts, the expenses of Accounts 398 to 400 for these trains are almost entirely charged in the Quebec district. To correct for this, the Canadian Pacific removed the locomotive-miles attributable to these trains from the other districts and added them to those for Quebec. The regression analysis was repeated, yielding:

(34)	Expenditures=	\$29,944	
		+\$0.15512 per locomotive-mile (steam)	(2.55)
	R^2=.89	+\$0.18068 per locomotive-mile (diesel)	(5.35)

Canadian Pacific do not keep diesel unit mile statistics by division. However, Canadian National do. Attempts by the Canadian National to analyse this account using diesel unit miles resulted in a group of equations with utterly insignificant or negative coefficients for diesel unit miles.[1] It appears quite likely that the higher coefficient for diesel locomotives is due to the definition of locomotive as a single unit for steam and as the combined units on a train for diesel.

The Canadian National use of yard locomotive-miles was suggested by the fact that under steam practices enginehouses were situated where yard switching took place. Yard locomotive-miles were used as a proxy size variable.

While the railways' models (equations (32) and (34)) have been accepted for this report, the analyses of these accounts, carried out by the various parties, indicate that here again, the explanations of expenditures have not been satisfactorily related to the determinants of the expenditures.

7. *Gross Investment in Road Property*

CANADIAN PACIFIC RAILWAY

(35)	Gross Investment=	\$34,125,798	(2.67)
	(Road Property)	+\$15,130,387 per mile of track	(3.39)
		+\$4.35896 per thousand gross ton-miles	(5.11)
	R^2=.75	+\$12.66340 per yard and train switching mile	(1.87)

As noted below in Section C, the Canadian National could not perform this analysis.

[1] Unpublished study.

R. L. Banks and Associates could not accept the low "t" value of the coefficient for yard and train switching miles. To avoid this they constructed two models:

West

(36)	Gross Investment=	\$60,550,000	(2.76)
	(Road Property)	+\$3.4360 per thousand gross ton-miles (1 frt. + 2 passengers)	(3.68)
		+\$12,520 per mile of track	(2.28)

East

(37)	Gross Investment=	\$48,648,700	(2.14)
	(Road Property)	+\$6.6080 per thousand gross ton-miles (1 frt. + 2 persons)	(5.43)

Although these two models increased the significance of the coefficients, they did so at the expense of deleting miles of track from the eastern equation. It is difficult to accept an explanation of investment in road property which does not contain any variable representing the physical size of the railway.

Analysis of the type carried out for the Account 202, etc., complex might well prove to be more successful than the Canadian Pacific Equation which is accepted for this report.

8. *Other Regression Analyses*

The following groups of accounts were analysed by the railways using regression techniques. None was challenged by the consultants of the provinces or grain-handling organizations and none was examined critically by the Commission Consultants.

(a) Maintenance of Fences, etc.

CANADIAN PACIFIC RAILWAY

Accounts Explained 221 Fences, Snowsheds and Signs—Maintenance
266 Depreciation

(38)	Expenditures=	\$604,565	(4.42)
	R^2=.78	+\$34.61040 per mile of right of way fences	(9.34)

CANADIAN NATIONAL RAILWAYS

Accounts Explained 221 Fences, Snowsheds and Signs

(39) Expenditures= $3,264.06
R^2=.67 +$40.008 per mile of fence (7.43)

(b) **Water and Fuel Stations**

CANADIAN PACIFIC RAILWAY

Accounts Explained 231 Water and Fuel Stations—Maintenance
266 Depreciation

(40) Expenditures= $285,035 (2.07)
R^2=.64 +$0.01070 per dollar of fuel expense (2.88)
+$0.45140 per dollar of water expense (4.92)

CANADIAN NATIONAL RAILWAYS

Accounts Explained 231 Fuel and Water Stations

(41) Expenditures= $10,284
R^2=.43 +$0.010915 per total locomotive-mile (steam) (2.81)
+$0.006481 per total locomotive-mile (diesel) (2.21)

9. *Expenses Assigned Directly*

Both railways obtained the costs for grain doors, including the costs of repair (part of Account 402), and the claims for loss and damage (part of Account 418), directly from company records. From these figures, the portion applicable to domestic grain shipments was removed.

The Canadian Pacific submitted figures based upon the average experience for the years 1956-58.

In the case of grain doors the Canadian Pacific argued that:

> "the purchase of grain doors in any one year cannot be related directly to the use of grain doors in that year. Consequently, a three-year period averages out variations from year to year in the purchase and in the use of grain doors."[1]

R. L. Banks and Associates presented the following data:[2]

TABLE IV—COMPARISON OF GRAIN SHIPMENTS AND GRAIN DOOR EXPENSE

Year	*Waybills at statutory rates*	*Per cent of 3 yrs.*	*Grain door expense–CPR*	*Per cent of 3 yrs.*
1958	2,400	29.6	$ 761,808	30.1
1957	2,572	31.8	764,580	30.3
1956	3,129	38.6	1,000,347	39.6
Totals	8,101	100.0	2,526,735	100.0

SOURCE: Board of Transport Commissioners for Canada, "Waybill Analysis Carload All-Rail Traffic, 1958; CPR".

[1]Transcript of evidence, *Hearings*, January 16, 1961, Vol. 130, p. 22507.
[2]Transcript of evidence, *Hearings*, November 10, 1960, Vol. 116, p. 19227.

The data is evidence that, although grain door expense cannot be related precisely to the use of grain doors in a given year, the expenses for that year can be expected to give a better estimate for that year than will an average of that and the two preceding years. Therefore, in this report grain door expense has been taken as that for 1958.

In the case of loss and damage, the three-year average presented by Canadian Pacific was contained in Exhibit 132. This was a revision of the original estimate. In presenting this revision, the Canadian Pacific stated that the adjustment was made "to make (this) consistent with other parts of the study".[1] The Canadian Pacific also argued, "Obviously a three year average reflects better claim experience than a one year figure, because claim payments are not necessarily paid in the year in which the loss or damage was incurred."[2]

This claim could well be tested in future research by the use of a lagged time series regression analysis of, say, net ton-miles of grain against loss and damage payments: that is, to explain the loss and damage payments in a given year, the revenue ton-miles of that and successive previous years could be used as variables in a multiple regression.

The extent to which payments of claims for loss and damage are deferred until future years is the determinant of the degree to which averages over years should be used rather than the costs for a given year. It may be placing too much emphasis upon the precision of the language of the statement quoted above but, nevertheless, in this report the costs for 1958 have been used because of the language of that statement—that claim payments are not *necessarily,* rather than usually, paid in the year in which the loss or damage occurred.

In both of these cases the Canadian National used the costs for the year 1958.

10. *Expenses Allocated*

Certain accounts were allocated to grain according to the number of the relevant output units attributed to grain. This procedure assumes that the average expense is constant over any range of output units. Put another way, it assumes that the relationship between the expenditures and the output units can be represented by a straight line through the origin. In some cases there may be statistical evidence that this relationship does, in fact, exist. In other cases, the procedure is resorted to because, although the relationship cannot

[1] Exhibit 132, Canadian Pacific Railway, Revision to Results of Cost Study for Moving Grain and Grain Products at Statutory and Related Rates to Export Positions in Western Canada, Arising from Suggestions and Tests Proposed by Commission Staff, Consultants of Grain Trade and Provinces, and Canadian Pacific, p. 6.

[2] Transcript of evidence, *Hearings,* January 23, 1961, Vol. 132, p. 22508.

be demonstrated statistically, it seems reasonable to believe that the expenses will vary according to the particular output units chosen, and no more accurate representation of the relationship can be found.

For this report, the allocations performed by the railways have been accepted. Some of these allocations were challenged by other consultants. There were not, however, clear demonstrations that superior methods of allocation had been found. The choice between methods had to be made on an arbitrary basis. The railways' estimates for these accounts have been accepted essentially because this was the simplest procedure for the Commission staff. The decision to proceed on such a basis was made easier by the knowledge that the amounts involved in the choice between methods of allocation are small.

The attached lists show the methods used by the two railways to assign expenditures. The order of presentation was different in the two cases. This difference in order of presentation has been preserved. The number of cases in which a different method was used by the two railways for the same account is very small, so that the lists are almost interchangeable. Although these differences should be kept in mind, those who wish to examine the treatment of specific accounts will find the list prepared by the Canadian Pacific of greater value. Those who wish to examine the application of particular methods of analysis will find the list prepared by the Canadian National of greater value.

Exhibit No. 61

CANADIAN PACIFIC RAILWAY

GROUPING OF EXPENSE ACCOUNTS IN THE COST STUDY AND METHODS USED TO DETERMINE COST

Account Numbers	*Name*	*Method*
Road Maintenance		
201, 274, 276, 277	Road Maintenance Superintendence and Overhead	Regression Analysis
202, 208, 212, 214, 216, 218, 229, 266, (Track) 269, 271, 273, 281	Track Maintenance and Depreciation	Regression Analysis
221-266	Fences, Snowsheds and Signs Maintenance and Depreciation	Regression Analysis
227-266	Station and Office Buildings Maintenance and Depreciation	Regression Analysis
231-266	Water and Fuel Stations Maintenance and Depreciation	Regression Analysis and Direct
235-266	Shops and Enginehouses Maintenance and Depreciation	Regression Analysis
237-266	Grain Elevators	Not applicable
241-266	Wharves	Not applicable
247	Rail Communication Systems	Allocated
249-266	Signals Maintenance and Depreciation	Regression Analysis
253-266	Power Plant Maintenance and Depreciation	Regression Analysis
265-266	Other Structures	Not variable
270	Dismantling Retired Road Property	Not variable
272	Removing Snow, Ice and Sand	Not variable
275, 278-279	Insurance and Joint Facilities	Allocated
Equipment Maintenance		
301, 302, 305, 306, 329, 332, 333, 334, 335, 336, 337	Equipment Maintenance, Superintendence and Overhead	Regression Analysis
308-311-331	Road Locomotive Repairs and Depreciation	Direct
308-311-331	Yard Locomotive Repairs and Depreciation	Direct
314-331	Freight Train Car Repairs and Depreciation	Direct and Allocated
317-331	Passenger Train Car Repairs and Depreciation	Not applicable
323-331	Vessels Repairs and Depreciation	Not applicable

GROUPING OF EXPENSE ACCOUNTS IN THE COST STUDY AND METHODS USED TO DETERMINE COST—*Cont.*

Account Numbers	*Name*	*Method*
Equipment Maintenance—Conc.		
326-331	Work Equipment Repairs and Depreciation	Allocated
328-331	Other Equipment Repairs and Depreciation	Not applicable
Traffic		
351, 352, 353, 354, 356, 357, 358, 359	Superintendence, Agencies, Advertising, Associations, Industrial and Immigration Bureaus, Insurance, Stationery and Other Expenses	Allocated and Not applicable
Transportation		
371, 374, 410, 411, 415, 416, 420	Transportation Superintendence and Overhead	Regression Analysis
372, 373, 376	Dispatching and Station Employees and Expenses	Regression Analysis
375	Coal and Ore Wharves	Not applicable
377	Yardmasters and Clerks	Regression Analysis
378, 379, 380, 382, 385, 389	Yard Expenses	Regression Analysis
386, 388	Yard Other Expenses	Regression Analysis
390-391, 412-413, 414	Joint Facilities and Insurance	Allocated
392, 394, 401	Train Enginemen, Train Loco. Fuel and Power, Trainmen	Direct
397	Train Locomotive Water	Direct
398, 400	Train Enginehouse Expenses and Train Locomotive Other Supplies	Regression Analysis
402	Train Other Expenses	Direct and Allocated
403	Operating Sleeping and Parlor Cars	Not applicable
404	Signals Operation	Regression Analysis
405	Crossing Protection	Not variable
406	Drawbridge Operation	Not variable
407	Rail Communications System Operation	Allocated
408	Operating Vessels	Not applicable
418	Loss and Damage—Freight	Direct
419	Loss and Damage—Baggage	Not applicable

GROUPING OF EXPENSE ACCOUNTS IN THE COST STUDY AND METHODS USED TO DETERMINE COST—*Conc.*

Account Numbers	*Name*	*Method*
Miscellaneous Operations		
441	Dining and Buffet Service	Not applicable
442	News Service and Restaurants	Not applicable
443	Grain Elevators	Not applicable
446	Other Operations	Not applicable
447-448	Misc. Joint Facilities	Not applicable
General		
451, 452, 453, 454, 455, 457, 458, 460, 461-462	General Officers, Clerks and Attendants, Office Expenses, Law Expenses, Insurance, Pensions, Stationery, Other Expenses and Joint Facilities	Allocated
Equipment Rents		
463-464	Equipment Rents	Direct and Allocated
Joint Facility Rents		
465-466	Joint Facility Rents	Allocated
Railway Tax Accruals		
468	Other Railway Taxes	Allocated
Investment		
	Road Property	Regression Analysis
	Locomotive—Steam and Diesel	Direct
	Freight Train Cars	Direct
	Passenger Train Cars	Not applicable
	Vessels	Not applicable
	Work Equipment	Allocated
	Other Equipment	Not applicable

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CANADIAN NATIONAL RAILWAYS
METHODS OF ANALYSIS[1]

Expense Accounts Analysed by Statistical Regression Methods

Road Maintenance	*Railway Expense Account Numbers*
Track and roadway	202, 208, 212, 214, 216, 218, 229, 269, 270, 271, 273, 281
Fences, snow sheds and signs	221
Station and office buildings	227
Fuel and water stations	231
Shops and enginehouses	235
Power plant systems	253
Removing snow, ice and sand	272
Superintendence and miscellaneous	201, 274, 275, 276, 277
Transportation	
Superintendence and miscellaneous	371, 374, 410, 411, 414, 415, 416, 420
Train control	249, 372, 404
Station employees and expenses	373, 376
Yardmasters and yard clerks	377
Yard locomotive enginehouse and other expenses	386, 388
Yard other expenses	389
Train locomotive other supplies and enginehouse expenses	398, 400

Direct Expenses and those Expenses to be Analysed by Special Studies

Road Maintenance	
Rail communication systems, maintenance and operation	247, 407
Road property—depreciation	266

[1] Exhibit 57, Precis of evidence of Canadian National Railways, Sect. IV and VII, Statutory and Related Rates on Grain and Grain Products in Western Canada, p. 25-28.

Direct Expenses and those Expenses to be Analysed by Special Studies—Conc.

Equipment Maintenance	*Railway Expense Account Numbers*
Diesel locomotives	311A
Freight train cars	314
Work equipment	326
Shop and power plant machinery	302
Superintendence and miscellaneous	301, 306, 329, 332, 333, 334, 335
Other equipment and machinery—depreciation	305
Rolling stock and vessels—depreciation	331
Traffic	
Total traffic expenses	351, 352, 353, 354, 356, 357, 358, 359
Transportation	
Yard trainmen and enginemen	378, 380
Yard switchmen	379
Yard locomotive fuel and power	382
Train enginemen and trainmen	392, 401
Train locomotive fuel and power	394
Train other expenses	402
Loss and damage—freight	418
General	
General officers, clerks and others	451, 452, 453, 454, 455, 458
Pensions	457
Railway Tax Accruals	
Other railway taxes	468
Others	
Joint facilities	278, 279, 336, 337, 390, 412, 413, 465, 466

Expense Accounts which are not Affected by the Movement of Western Grain Traffic or are Related to Steam Operation

	Railway Expense Account Numbers
Road Maintenance	
Grain elevators	237
Wharves	241
Other structures	265
Equipment Maintenance	
Steam locomotives	308
Other locomotives	311B
Passenger train cars	317
Vessels	323
Other equipment	328
Transportation	
Coal and ore wharves	375
Yard locomotive fuel and power	382
Yard locomotive water	385
Train locomotive water	397
Operating sleeping and parlour cars	403
Crossing protection	405
Drawbridge operation	406
Operating vessels	408
Loss and damage—baggage	419
Miscellaneous Railway Operations	
All expenses	441, 442, 443, 446, 447, 448
Equipment Rents	
All expenses	463, 464
Express, Commercial Communications and Highway Transport (rail) Operations	
All expenses	470, 471, 472, 473, 474, 475, 480, 481, 482, 483, 484, 490, 491, 492, 493, 494, 495

B. The Estimation of the Output Units

1. *Revenue Ton-Miles, Loaded Car-Miles, Number of Carloads, Loaded Car Handlings*

Both the Canadian Pacific and the Canadian National searched waybills to determine the revenue, the number of tons of the study traffic, and the number of cars of export grain which originated at each station. Field studies determined the routes over which this traffic is moved to export positions and the percentage of this traffic which travelled by each route. From the results of these studies, the mileage travelled by each carload could be determined. These mileages were then multiplied by the number of tons and cars originated to determine the number of revenue (net) ton-miles and the number of car-miles.

2. *Gross Ton-Miles, Loaded*

Gross ton-miles were found by multiplying the average tare weight of box cars used in grain service to give tare ton-miles. This was added to the net ton-miles to produce gross ton-miles. In each case the average tare weight was found by examination of the records for a sample of the cars actually used in the grain trade.

3. *Gross Ton-Miles Empty, Empty Car-Miles, Empty Car Handlings*

Each railway studied a sample of the box cars which were used in the grain trade in 1958. The movements of these cars were traced from the point at which the grain shipments originated back to the point from which they had been dispatched, empty, to receive grain. The information found by this tracing was treated in the manner described above, to develop these output units.

4. *Active Car Days*

The records on freight cars include the dates at which the cars were at various points. For their respective samples, the railways calculated the total time which the cars carrying grain were under load plus the time of related empty movement. The results of this study were then "blown up" to give a figure for the total study traffic.

To allow for the extra time which would be required for "back-shop" repairs, the Canadian National increased their total active time by a factor of 2.4 per cent. This represented the proportion of cars in the shop for repairs at a sample time. The Canadian Pacific excluded all storage and repair times.

In a revised statement (Exhibit 132), the Canadian Pacific recalculated the number of car days chargeable to the grain trade. A new method was used involving the use of calendar car days. For the box car fleet as a whole this would be simply the average number of box cars in the fleet times 365. A sample of 300 box cars was examined to find the proportion of active and idle car days. Approximately one-half of this sample was composed of cars which had been included in the original study of grain cars. The other half were cars which were drawn from the entire box car fleet. The ratio of idle car days to active car days was then applied to the active car days found by the procedure outlined above.

To take account of the fact that Canadian Pacific cars are sent to other railways, the "off-line" days of the cars in the sample of 300 were removed from consideration. This had the effect of reducing the number of days in which a car was considered to belong to the Company's fleet, from 365, by the number of days which the car was off-line. An allowance of ten per cent of the off-line days was also deducted as an allowance for idle time connected with off-line movements. In justification of this procedure, it was pointed out that the per diem rate for car-hire, which the Canadian Pacific receives, includes an allowance to cover an assumed rate of non-utilization of approximately ten per cent.

Observation of the Canadian Pacific's car service records shows no way in which one could decide whether or not off-line service causes any different amount of idle time than does on-line service. The procedure which the railway followed does assume that off-line service causes a lower amount of idle time than does on-line service. This was justified on the grounds that the railway is paid only for the days included in the ten per cent allowance and that therefore the costs which arise out of the remaining idle days which can be attributed to off-line service must be recovered from traffic carried on-line. Nobody can deny that if the per diem allowance for car rental is insufficient to cover the costs of providing the cars, the excess cost must be covered by on-line service. This, however, does not justify a procedure which attributes a cost arising out of off-line service to an on-line service. (In fact, no evidence was brought forward to indicate whether the per diem allowance was reasonable and whether it covered more or less than the ten per cent idle time allowed.)

The Canadian Pacific procedure charged 58 days idle time for each 100 days of active on-line time. Had the charge to off-line days been made consistent with that to on-line days, this would have been reduced to 44 days; that is, a reduction of almost 25 per cent in the idle days charged, or of almost 9 per cent in the days chargeable to on-line traffic would have been made.

W. B. Saunders and Company argued that the largest part of the idle time experienced by the Canadian Pacific is due to the need to hold cars

in readiness for peak shipping periods. Since this need is related to loads originated rather than to the number of days the average car remains under load, it was argued that originations rather than active car days is the appropriate measure by which idle car days should be allocated. This procedure would have the unfortunate effect of placing the burden of providing cars for peak periods upon traffic which has many short trips and relieving traffic which has few long trips. To give a simple example, consider a railway which has four box cars, of which, over a thirty-day period two remain idle, one is active for thirty days carrying two loads of grain, and one is active for thirty days carrying thirty loads of newsprint. Under the Saunders' procedure the car carrying grain would have assigned to it just slightly over six per cent of the time of the two idle cars, while the car carrying newsprint would have slightly under 94 per cent assigned to it. While, under these simplified conditions, it might be argued that one of the idle cars was standing by in case of repairs to the newsprint car or in case a few extra loads were offered, it seems difficult to accept that over 90 per cent of the idle time would be due to the newsprint trade.

An alternative procedure is to admit frankly that the provision of idle time causes an overhead cost which is difficult to assign meaningfully. Costs arising from the necessity of idle time would not then be included in the variable or marginal costs of specific movements. This is the procedure followed by the Canadian National (except that that railway allowed for time in back-shop repairs).

A second method which might be applied stems from a modification of the Saunders' argument. Since the preponderant majority of idle time appears to come from the existence of idle capacity to provide for peak periods, observations might be made during the month of greatest box car utilization. Idle time for the year might then be assigned on the basis of the active car days for that month. Such a procedure would necessitate the collection of no data which the railways did not collect during the present study and would call for few additional calculations.

Both R. L. Banks and Associates and W. B. Saunders and Company asserted that, in performing their second analysis, the Canadian Pacific had calculated the number of active car days in a different way than they had calculated them in the original study. Since the results of the second study were applied to the active car days of the first study, such a procedure would obviously result in an error. The two consulting firms argued that the error was such as to increase the car days chargeable to grain. This topic was discussed at length, both verbally before the Commission staff and in correspondence. It became evident that the only way in which the question could be decided finally would be by means of a repetition, by the Commission staff, of a great deal of the second Canadian Pacific study. This, time would not allow.

Since it was impossible to make a re-evaluation of the counting methods employed by the Canadian Pacific, and since their adjustment for off-line active days had been rejected, an alternative method of estimating the number of car days attributable to grain on the Canadian Pacific had to be found. The Canadian National estimated that it required 3,547,084 car days for the transport of 5,957,631 thousand net ton-miles of grain, that is, .59538 thousand car days per ton-mile. Application of this ratio to the net ton-miles carried by the Canadian Pacific yields an estimate of 4,189,930 car days. This may be compared with the original Canadian Pacific estimate of 3,257,123 car days and their subsequent estimate of 5,073,742 car days.

Quite obviously this method of estimating costs upon the Canadian Pacific is far from satisfactory. We console ourselves with the knowledge that the absence of an allowance for back-shop repair time made the first estimate too low (although one would not expect it to be 20 per cent too low for this reason): the allocation of idle time presumably allocatable to off-line movements made the second estimate too high. A better estimate should lie between these extremes. Further, it is not unbelievable that conditions and technical ability on the two railroads would lead to the need for a similar number of available cars per ton-mile of transportation supplied for the same commodity.

5. *Train-Miles*

In order to compute train-miles the railways first estimated the number of trains which would be required to carry grain on each train-run. To do this they made adjustments to the gross weight of grain cars and trains to allow for the fact that the tractive effort to pull an empty car, compared to a loaded car, is greater than a simple comparison of their gross weights would indicate. The weights of trains and grain shipments were, therefore, measured in equivalent gross tons (Canadian Pacific) or equated gross tons (Canadian National). These two terms merely indicate that the two railways follow different formulae to allow for the different tractive efforts required with different weights of loading. In the remainder of this section weight will mean equivalent or equated weight unless otherwise stated.

The Canadian Pacific estimated the number of trains by multiplying the average weight of train, by train-run by direction, by the proportion which the weight of grain was to total traffic for that train-run.

The Canadian National estimated the number of trains on way-freight runs by multiplying the number of trains on each run by the ratio of the number of grain carloads originated to the total number of carloads originated. For through train-runs, the Canadian National divided the total weight of grain shipments by the average weight for the run.

The methods employed by the railways assume that trains are infinitely divisible, that is, that if there is sufficient traffic for two trains per week and the available traffic is halved, one train per week will be run. If the available traffic is again halved one-half train per week (one train every two weeks) will be run, and so forth. The Canadian Pacific defended this assertion through an examination of the flexibility of way-freight scheduling, and a check of the average weights of way-freights on runs varying from service of four or more trains per week to service as and when required. The results of this examination persuaded them that there is a rough constancy in the trailing weights of way-freights.[1]

As a further check upon this assumption, the Commission staff performed a regression analysis of the relationship between freight gross ton-miles (but not equivalent gross ton-miles) per division and freight train-miles per division. Three-year averages (1956-1958) for the Canadian Pacific were used for the 28 divisions for which these data are available. If train-miles per division are not directly proportional to gross ton-miles, this may be due to the fact that if a line is in existence there will be pressure upon the railway company to provide a minimum frequency of service. There will, therefore, be a tendency of those divisions which have light density to have relatively more train-miles per division than those which have heavy density. (The higher the density per mile of road, the greater will be the opportunity to make up full-tonnage trains without seriously lessening the speed of service.) To test this hypothesis, miles of road were inserted as an explanatory variable. The resulting equation was:

$$\begin{aligned} \text{Train-miles} = \; & 228{,}380 \\ & +.34637 \text{ gross ton-miles ('000)} \qquad (t=20) \\ & +171.33 \text{ miles of road} \qquad (19) \\ R^2 = \; & .945 \end{aligned}$$

For the system as a whole, for this period, there was, on the average, one train-mile for each 2,000 gross ton-miles. Yet this regression indicates that train-miles are added or subtracted with changes of traffic volume at the rate of one train-mile for each 2,900 gross ton-miles. It appears that the assumption of complete divisibility of trains overstates the marginal cost of traffic. (In this case, the constant appears to be a reflection of the inability of a linear model to follow a curved function which would go through the origin. See Figure 5 which shows the train-miles, after adjustment for miles of road, plotted against gross ton-miles.)

A better test of the relationship between train-miles and gross ton-miles would utilize the records of equivalent or equated gross ton-miles. Further, data are available which could be adapted to test this relationship,

[1] Transcript of evidence, *Hearings*, May 11, 1960, Vol. 117, p. 11905.

not only on a divisional basis but also upon a train-run basis both by direction and without regard to direction. Such a test might shed valuable light not only upon this problem but also, as a corollary, upon the problems of the railways in maintaining light-density lines.

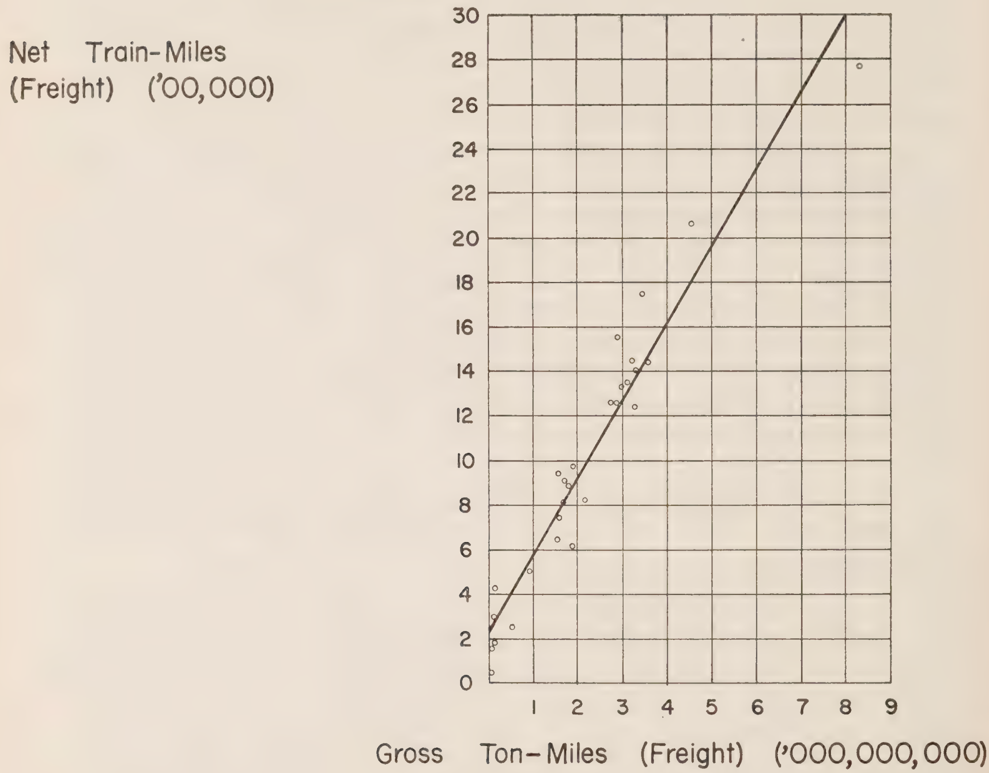

FIGURE 5: Relationship between Train-miles (freight) and Gross ton-miles (freight) for Canadian Pacific Railway after allowance for the effect of miles of Road.

It was argued by the consultants who appeared on behalf of the Provinces of Alberta and Manitoba and of the grain organizations, that grain is carried on heavier trains than other traffic, and that, therefore, grain requires fewer trains than other traffic in relation to the equivalent gross ton-miles carried.

W. B. Saunders and Co. analysed the contents and weight of 119 trains studied by the Canadian Pacific, in three sample periods totalling 23 days, on the Winnipeg-Fort William run. Their conclusions follow.

> "The average weight of all trains in the study was 4,302 equivalent gross tons. This is the equivalent of the train weight that CPR imputed to eastbound grain loads on this train run in 1958. The total weight of non-grain traffic, including empty cars, was 274 thousand equivalent gross tons. On a prorata basis, train for train, this traffic was assigned 73.4 trains, which produces an average weight of 3,733 equivalent gross tons, or 13 per cent less than the average. In contrast, the 238 thousand equivalent gross tons of grain, accounting for the remaining 45.6 trains, averaged 5,219 equivalent gross tons per train, 21 per cent more than the average. This is the train tonnage properly assignable to grain on this train run, and suggests that, if the study period is representative of 1958, the CPR overstated eastbound train miles by 21 per cent. It should be noted that the Kenora division, of which the portion from Winnipeg to Fort William is overwhelmingly the most important part, accounted for 33 per cent of the total grain study gross ton-miles.
>
> "The above study exposes the fallacy of the assumption that because many, if not most, trains carry some grain, an average train weight is proper. It showed that 89 of the 119 trains carried some grain. For 47, grain made up less than half of their consist. These trains averaged 3,684 equivalent gross tons. The other 42 trains had more than 50 per cent grain, and averaged 5,406 equivalent gross tons. The higher the proportion of grain, the heavier the train, seems to be a good generalization. The latter group of trains, in fact, while fewer than half the total trains, carried 85 per cent of the grain!"[1]

In order to compensate for this overstatement, R. L. Banks and Associates estimated the train-miles which would have been required if all grain moved in full-tonnage trains between Alyth, Alberta, and Vancouver and between Moose Jaw and the Lakehead. After computing the train-miles which would be required in the loaded direction, they assumed that an equal *saving* in train-miles could be made in the opposite direction. Since the Canadian Pacific had estimated the train-miles required in the empty direction separately, the Banks' estimates probably under-estimate the train-miles required. This error will be more or less compensated by conservative elements in their calculations, in particular that no new estimates were made for main-line traffic from Moose Jaw to Alyth, and that they assumed that all trains were hauled by 1600-1800 H.P. diesel units and ignored the possibility that the Canadian Pacific might employ their 2400 H.P. units on these runs. The Banks' amendments are therefore accepted as fair revisions.

The Canadian National method of attributing way-freight miles to cars rather than to ton-miles appears to have considerable merit. If one thinks of a way-freight which has a run of thirty miles and which collects thirty cars, each of fifty gross tons, one each from points one mile apart, some 23,250 gross ton-miles will have been generated of which 1,500 or

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[1] Transcript of evidence, *Hearings*, November 11, 1960, Vol. 117, p. 19509-19510.

about 6½ per cent will have been generated by the last car. Since, in fact, carrying the furthest car caused an extension of only one mile in the train's run, slightly over 3 per cent would appear to be a fairer charge. To take another case, if those cars which are heavily laden happen to be carried a shorter distance than those which are lightly laden, the heavier cars could be charged more than the lighter even though they cannot call for the train to travel as many miles. These are, of course, simple examples which leave most of the complications of actual way-freight operations out of the picture. They do, however, lend support to the view that since the function of way-freight operations is to collect and distribute cars, the train-miles generated in these operations might better be allocated over the cars handled rather than over the weight and distance travelled by these cars.

6. *Yard and Train Switching-Miles*

Each of the railways conducted field studies at representative yards to determine the switching time necessary for the grain traffic. The yards studied account for 74 per cent of the western terminal operations in the case of the Canadian Pacific and 83 per cent in the case of the Canadian National.

Argument on the switching studies centred about the desirability of making an allowance for the tendency of grain to move in strings of cars which require less switching than traffic generally, and the allowance to be made for switching under the difficult conditions of the winter months.

The Canadian National made no allowance for the fact that grain moves in multiple car lots but argued that as they had made no allowance for winter conditions, the error in one direction was compensated by an error in the other.

The Canadian Pacific argued that the savings from multiple car cuts are quite small, and that in any event traffic generally does not have a significantly smaller number of cars per cut than does the grain traffic.

The Canadian Pacific argument that there is little effect on costs was contained in the following paragraphs: [1]

> "An analysis of the operations performed in classification yards shows that the elements of classification should be broken down into six categories. In only one of these elements of classification, that is in the "Kick Cut to Clear", is there any operating reason to believe that size of cut would influence classification time. Most of the elements are simply a function of handling a train or of moving an engine for work which must be done to an entire train. The elements are as follows:
>
> (a) *Light Movement*
> This element of classification involves the movement of the light engine in preparation to begin work or after the completion of an assignment. The light movement is not related to the size of the cut

[1] Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22583-22587.

since the distance that the engine must travel depends entirely on the point from which it starts and the distance it must travel before coupling on to the string of cars to be handled.

(b) *Bleed Cars*
This element entails the releasing of air from the brake cylinders of cars to be handled. The time required depends entirely on the number of cars in the string of cars to be handled. The size of cuts in the string has no bearing on the time required for performing this element. Bleeding is accomplished by the yardman walking alongside the string of cars and pulling a lever on each car which releases the air from the brake cylinder.

(c) *Initial Pull to Classify*
This element consists of pulling a string of cars from the point where they were to the point from which switching will commence. The time required to perform this function is related to the distance the cars must be pulled as well as the number of cars in the string of cars. It has no relationship to the number of cars in the individual cuts in the string.

(d) *Kick Cut to Clear*
This element involves the actual kicking of the cars from the string of cars and permitting them to roll freely to their destination. The time required for this element of classification is that time elapsing from the time the signal is given to the engineman to kick the car until the car has cleared the fouling point of the lead or the engine is given the subsequent signal to move. It is in this type of switching movement where size of cut might affect classification time.

(e) *Trim Ladder Tracks*
This element of classification involves the shoving of cars into their respective tracks when they have stopped on the lead track, or fouled on the lead track, or when they have not entered the track sufficient distance to permit following cars to be placed in the track clear of the lead. This element of classification is not related to the number of cars in the cuts.

(f) *Walk and Couple Tracks*
This element involves the coupling of cars in tracks. Since the yardman is required to walk the entire distance of the track if all the cars on that track are to be coupled up, the number of cars in cuts will not affect the distance required for him to walk. The presence of automatic couplers on freight cars results in cars automatically coupling when they are kicked into tracks in almost all cases. The time to adjust couplers which did not automatically operate is not the effective time element.

"Thus in examining the six elements into which classification switching may be segregated, in only one of these elements, the "kick cut to clear" element, can classification time be affected by size of cut.

"As the only measurable influence of multiple car cuts on classification time is in the element "kick cut to clear", Canadian Pacific used the results of an exhaustive study in a flat switching classification area in Winnipeg terminals, in which trained yard analysts have timed the work which is involved in the "kick cut to clear" element of classification. The relative importance of the kick cut to clear element in classification time was also determined.

"The percentage of total classification time of the six elements of classification time in the study area was found to be as follows:

(1) Light Movement	7.30%
(2) Bleed Cars	0.02%
(3) Initial Pull to Classify	38.38%
(4) Kick Cut to Clear	26.73%
(5) Trim Ladder Tracks	6.33%
(6) Walk and Couple Tracks	21.24%
Total	100.00%"

From this argument, the Canadian Pacific concluded that only 26.73 per cent of classification time is affected by multiple cuts.

In discussions with consultants who appeared before the Commission, and with others who have knowledge of switching operations, the Commission staff discovered that the following arguments can be raised.

(a) *Light Movement*
When there are a larger number of cars in each cut, there will be a tendency to move larger strings of cars. While each light movement will be of the same length, there will be fewer movements. Therefore, with larger cuts there will be less light movement.

(b) *Bleed Cars*
No arguments were advanced to support the idea of savings in the time to perform this element.

(c) *Initial Pull to Classify*
Savings in this element can arise for reasons similar to those of light movement—there will be fewer trips with larger cuts.

(d) *Kick Cut to Clear*
It is agreed that there are savings in this element.

(e) *Trim Ladder Tracks*
The kick necessary to have cars clear the lead track depends upon several factors. Some of these are the weight of load in the car, the type of car and the weather conditions. Cars will be left on the lead track, or will be insufficiently far down their own track if the combined effect of these factors is misjudged. With larger cuts, there will be fewer cuts for the same size of train. There will therefore be less chance of needing the ladder tracks trimmed because of misjudgement. Thus there can be a saving in this element with multiple car cuts.

(f) *Walk and Couple Tracks*
When a yardman does have to couple cars which have not coupled automatically, the job can be very time-consuming. Again, with larger cuts there will be fewer cuts for trains of the same size and, therefore, less need of that part of this job which can vary.

Thus, it can be argued that 99.98 per cent of classification work is susceptible to savings because of larger cuts.

R. L. Banks and Associates attempted, with the data which was made available to them, to evaluate the savings which could be expected because of larger cuts in grain service than on average service. Although they admitted that this data did not allow them to present estimates which were as accurate as they would prefer, it is true that their estimates are the only ones which were presented to the Commission which have an empirical base for the switching function as a whole.

The Banks' organization quoted results of Mr. W. B. Wright who studied a flat yard of the Chesapeake and Ohio Railway. In Table V, the first three columns are from that evidence, the last two columns are from Canadian Pacific evidence, and refer only to the "Kick Cut to Clear" element.

TABLE V—FLAT YARD SWITCHING DIRECT YARD ENGINE MINUTES PER CAR

	Wright			Canadian Pacific	
Number of cars per cut	*Wright scale engine minutes[1] per cut*	*Average engine minutes per car[1]*	*Average engine minutes per car as % of single car switch*	*Average classification time per car[2]*	*Average classification time per car as % of single car switch*
1	3.16646	3.1665	100.00	.68	100
2	3.45606	1.7280	54.57	.37	56
3	3.74566	1.2485	39.43	.28	41
4	4.03526	1.0088	31.86	.25	36
5	4.32486	0.8650	27.32	.21	31
6	4.61446	0.7691	24.29	.19	28
7	4.90406	0.7006	22.13	.19	28
8	5.19366	0.6492	20.50	.17	25
9	5.48326	0.6092	19.24	.16	23
10	5.77286	0.5773	18.23	.14	21

[1]Transcript of evidence, *Hearings*, November 10, 1960, Vol. 116, p. 19157.
[2]Transcript of evidence, *Hearings*, January 23, 1961, Vol. 132, p. 22587.

The Banks' organization applied the percentage savings to Canadian Pacific data. It is clear that for at least one element, that of "kicking to clear", the Wright scale does in fact approximate Canadian Pacific experience.

For hump yards, a scale developed by Mr. E. C. Poole of the Southern Pacific was adopted by the Banks' organization.

It is now generally recognized that multiple car shipments do result in savings in switching time. For example, in deciding a recent case (though one in which much larger cuts were involved), the Interstate Commerce Commission recently remarked, ". . . the protestants' assigned cost ignores the movement of this traffic in multiple-car shipments, and obviously results

in an overstatement."[1] Since the Banks' estimates appear reasonable, and since there is not other empirical evidence on the costs of the entire switching function, these estimates have been accepted here.

In their revised estimates of Exhibit 132, the Canadian Pacific included an increased estimate of yard switching miles to reflect the fact that some grain shipments are switched under the more difficult conditions of winter. In making this adjustment, the fact that the Kenora yards were under winter conditions, at the time when they were studied, was overlooked. A small readjustment therefore had to be made.

C. Some General Problems

1. *The Adjustment Factor*

The railways worked, as far as possible, with accounts at the divisional level. Some expenditures are made and accounted for at district or system levels. In addition certain credits, for example for salvage, are made at district or system levels. In order to balance their estimates with the total system expenditures, the ratio of total expenses for the system to expenditures accounted for at the division level, was applied to the estimates for expenditures at the divisional level.

This procedure assumes that expenditures, or credits, which are accounted for at district or system levels will vary in the same fashion as do expenditures, or credits, which are accounted for at the divisional level. In most cases the adjustment factor was relatively small, so that any inaccuracies which might result in the use of these adjustment factors would be relatively small. In the case of the superintendence and overhead accounts, however, the adjustment was quite large. In addition, the nature of the system and district accounts for superintendence suggest that the amounts involved will tend to vary less slowly at district and system levels than at divisional levels, with given changes of traffic. In these cases, then, there may be some overstatement of the marginal cost.

2. *Depreciation*

Certain depreciation accounts are carried only at the system level. The Canadian Pacific distributed these accounts over divisions by prorating the depreciation according to gross investment in the division. The amounts so

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[1] Interstate Commerce Commission, Investigation and Suspension Docket No. 7256, Limestone in Trainloads—Prairie du Rocher, Ill., to Baton Rouge, La., December 22, 1960, p. 19.

prorated were then added to the divisional expenditures as recorded in the operating expenses. As the Canadian National does not have investment recorded at the divisional level, it found it necessary to prorate according to expenditures in the operating accounts, and the ratio of depreciation to operating expenditures was applied to the results of the estimation procedure based upon the divisional accounts.

Quite obviously the railways adopted these procedures because of the limitations of the accounts which they have inherited from years past when different problems were faced. It is well, then, that we should emphasize that criticism of the methods employed does not constitute criticism of the analysts who were forced to adopt these methods.

Proration of depreciation by gross investment is apt to penalize those divisions which are older, for these divisions are apt to have a greater proportion of their gross investment fully depreciated. They will, however, be charged with depreciation on the investment which no longer exists.

Proration of depreciation by expenditure on operating account is apt to have an error of another kind. To the extent which investment has taken place in labour saving devices, this method of proration will place the burden of depreciation on those divisions which have less investment, but a greater labour cost, and relieve those divisions which have more investment, but less labour cost.

As far as the Canadian National is concerned, there appears to be no solution to this difficulty until such a time as investment may be accounted for by divisions. The only alternative course of action would be to treat depreciation as a constant cost. Most people seem to feel that investment, and therefore depreciation, is controlled by the same factors as control operating expenditures. The Canadian Pacific regression model for investment in road property gives support to this view. The method adopted by the Canadian National appears to be preferable to treating depreciation as constant cost.

The Canadian Pacific method of prorating depreciation according to investment leads, as we have noted, to certain difficulties. These could be avoided by prorating on a basis of net investment. Inaccuracies would still remain, since different kinds of property carry different depreciation rates, and since these different kinds of property are unlikely to be present in the same proportions in every division. When these prorated values of depreciation are added to the values of the operating expenses, the inaccuracies of proration cause "errors of observation". These will tend to cloud what might otherwise be clearer relationships. It is therefore recommended that in future analysis attempts be made to secure relationships for operating expenditures and depreciation separately. It is to be hoped that the former will be stronger than any which have so far been developed for the

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respective categories of expense.[1] That the relationship will be lower for depreciation may be expected because of the difficulties with the prior proration. Different specifications of the two models may increase the combined validity of the explanatory models.

3. *The Grouping of Accounts and Specification of Models*

Certain accounts were grouped differently by the Canadian Pacific and Canadian National, and for certain groups of accounts different explanatory variables were specified. Since the technology of the two railroads, the climatic and geographical conditions under which they operate and their extent all appear to be roughly similar, it seems that this difference may be (a) because of differing views of the cost analysts, (b) because less than the best grouping was used by one group or both, or (c) because the nature of the available figures makes it impossible for one or other groups to act in any other way. In some cases, the first possibility was true. In some, the third was true. Whether the second possibility was true, only further research can demonstrate.

To aid in examining this question it is suggested that an examination of the data for each railway be made, using the methods of factor analysis, as, for example, centroid analysis or the method of principal components.[2] These are statistical methods of demonstrating which, and to what extent, different variables form groups. In addition they enable the creation of new and, if desired, independent composite variables, with a known relationship to the original variables. Among the more important insights into cost relations which might be gained from such an analysis is the degree, if any, to which categories of cost, removed from each other in the Standard Classification of Accounts, vary together.

In the following schedules, the estimates of variable cost for the Canadian Pacific are presented with the modifications discussed in this chapter. Considerations governing constant cost and the cost of money are discussed in the following chapters. In the case of the Canadian National, for reasons given earlier, no modifications have been made in variable cost. It is recommended, however, that future cost presentations of the Canadian National be modified in the same fashion, when those modifications apply to the estimates of that railway.

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[1] During discussions with W. B. Saunders and Co. regarding their models for track maintenance expense, this experiment was tried. The strength of the relationships, as measured by R^2 was in the expected direction. Certain other difficulties which emerged with the explanatory equations for depreciation may have been due in part to the difficulties discussed here, or may have been due to the fact that the specifications of the models examined were suitable for the operating accounts but were less so for the depreciation account.

[2] Cf. Meyer, J. R., and Kraft, G.: *The Evaluation of Statistical Costing Techniques as Applied in the Transportation Industry,* American Economic Review, Vol. LI, No. 2, May 1960, p. 327-333.

TABLE VI-a—CANADIAN PACIFIC RAILWAY

MARGINAL ROAD MAINTENANCE EXPENSE APPLICABLE TO THE STUDY TRAFFIC

	Account	*Group of accounts*	*Independent variable*	*Unadjusted coefficient or unit cost*	*Adjustment factor*	*Adjusted coefficient or unit cost*	*Output unit of study traffic*	*Applicable to study traffic*
1	201	Road Maintenance Superintendence	Gross Ton-Miles	$0.0064720	1.59587	$0.01033	12,233,795	$ 126,375
2	274	and Overhead	('000)					
3	276		Yard and Train					
4	277		Switching Miles	$0.052843	1.59587	$0.08433	844,556	71,221
5	202	Track Maintenance and	Gross Ton-Miles	←	See text and			
6	208	Depreciation	('000)		following note 1.		→	$ 2,211,685
7	212							
8	214		Yard and Train					
9	216		Switching Miles	$0.69143	1.01430	$0.70132	844,556	$ 592,304
10	218							
11	229							
12	266							
13	269							
14	271							
15	273							
16	281							
17	227	Station and Office Buildings	Carloads	$1.33237	1.06861	$1.42378	175,203	$ 249,451
18	266	Maintenance and Depreciation						
19	231	Water and Fuel Stations	$ of Fuel Expense	$0.01070	1.00285	$0.01073	2,464,262	[2]$ 26,441
20	266	Maintenance and Depreciation	$ of Water Expense	$0.45140	1.00285	$0.45269	60,496	[2]$ 27,384
21	235	Shops and Enginehouses	Yard and Train	$0.22343	1.31299	$0.29336	844,556	$ 247,759
22	266	Maintenance and Depreciation	Switching Miles					
23	249	Signals Maintenance and	Train-Miles	$0.04772	1.06483	$0.05081	2,538,683	$ 128,990
24	266	Depreciation	Main Line					
25	253	Power Plants Maintenance and	$ of Station	$0.01546	1.23230	$0.01905	885,043	$ 16,860
26	266	Depreciation	Employees					
27	275	Insurance and Joint	$ of Road Maintenance	$0.01060	1.00000	$0.01060	3,698,470	$ 39,203
28	278	Facilities						
29	279							
30								$ 3,737,673

[1]Since the relationship between gross ton-miles and expenditures is not linear, a simple multiplication will not yield the marginal cost. For each "grain-division" the expenditures attributable to the number of gross ton-miles carried by the division, less the gross ton-miles of grain, was subtracted from the expenditures attributable to the number of gross ton-miles of grain, including the gross ton-miles of grain. The resulting marginal cost was then multiplied by the adjustment factor to yield an estimate of the marginal cost of transporting grain. A minor (it is believed) inaccuracy results from the fact that total gross ton-miles were estimated as the three-year average. This means that the starting point along the cost curve was in error by the difference between the actual 1958 total gross ton-miles and the three-year average gross ton-miles.

[2]Since the explanation of this account was based on fuel and water expense, and since these, in turn, were estimated on locomotive miles or on an apportionment of these by train-run, an adjustment in the output units of study traffic was required when the basic estimates were adjusted.

TABLE VI-b—CANADIAN PACIFIC RAILWAY

MARGINAL EQUIPMENT MAINTENANCE EXPENSE APPLICABLE TO THE STUDY TRAFFIC

	Account	Group of accounts	Independent variable	Unadjusted coefficient or unit cost	Adjustment factor	Adjusted coefficient or unit cost	Output unit of study traffic	Applicable to study traffic
1	301	Equipment Mtce	$ of Direct Equip.	$ 0.04990	2.00526	$ 0.10006		
2	302	Suptce and Overhead	Mtce, Excl. Deprec.				6,378,694	$ 638,252
3	305							
4	306							
5	329							
6	332							
7	333							
8	334							
9	335							
10	336							
11	337							
12	308	Road Locomotive	Train-Miles	0.39718	—	0.39718	3,513,951	$ 1,395,671
13	311	Repairs	Train Swg. Miles	0.34653	—	0.34653	244,029	84,563
14		Yard Locomotive	Yard Loco-Miles	0.20762	—	0.20762	600,527	124,681
15		Repairs						1,604,915
16	314	Freight Train	Car-Miles	0.01712	—	0.01712	213,831,793	3,660,800
17		Car Repairs	Car Days	0.25363	—	0.25363	4,189,930	1,062,692
18								4,723,492
19	326	Work Equipment	$ of Road Maintenance	0.01352	—	0.01352	3,737,673	50,533
20		Repairs	Expense					
21	331	Road Locomotive	Train-Miles	0.16496	—	0.16496	3,513,951	579,661
22		Depreciation	Train Swg. Miles	0.26799	—	0.26799	244,029	65,397
23		Yard Locomotive	Yard Swg. Miles	0.14384	—	0.14384	600,527	86,380
24		Depreciation						731,438
25	331	Freight Train Car	Car-Miles	0.00427	—	0.00427	213,831,793	913,062
26		Depreciation	Car Days	0.22957	—	0.22957	4,189,930	961,882
27								1,874,944
28	331	Work Equipment Deprec.	$ of Road Mtce Ex.	0.00437	—	0.00437	3,737,673	$ 16,334
29								
30								9,639,908

TABLE VI-c—CANADIAN PACIFIC RAILWAY
MARGINAL TRANSPORTATION EXPENSE APPLICABLE TO THE STUDY TRAFFIC

	Account	Group of accounts	Independent variable	Unadjusted coefficient or unit cost	Adjustment factor	Adjusted coefficient or unit cost	Suptce	Total coefficient or unit cost	Output units of study traffic	Applicable to study traffic
1	371	Transportation	$ of Transportation	$0.02442	1.79756	$0.04390				
2	374	Superintendence and	Expense							
3	410	Overhead								
4	411									
5	415									
6	416									
7	420									
8	372	Dispatching and Station	Carload	$5.61490	10.1101	$5.67672	$0.24649	$5.92321	175,203	$1,037,764
9	373	Employees and Expenses								
10	376									
11	377	Yardmasters and Clerks	Yd. Switching Miles	$0.46992	1.09439	$0.51428	$0.02063	$0.53491	600,527	$ 321,228
12	378	Yard Expenses	Yd. Switching Miles	$2.37435	1.00498	$2.38617	$0.10423	$2.49040	600,527	$ 1,495,552
13	379									
14	380									
15	382									
16	385									
17	389									
18	386–388	Yard Other Expenses	Yd. Switching Miles	$0.14389	1.01193	$0.14561	$0.00632	$0.15193	600,527	$ 91,238
19	392	Train Enginemen, Train								
20	394	Loco. Fuel and Power, Trainmen	Direct[1]							$ 5,019,463
21	401	Train Switching	Direct[1]							$ 225,931
22	398	Train Enginehouse Expenses &	Locomotive-Miles[2]	$0.17221	1.02378	$0.17631	$0.00774	$0.18405	4,358,507	$ 802,183
23	400	Train Loco. Other Supplies								
24	397	Train Locomotive Water	Locomotive-Miles	$0.01331	0.99913	$0.01330	$0.00058	$0.01388	4,358,507	$ 60,496

TABLE VI-c—CANADIAN PACIFIC RAILWAY

MARGINAL TRANSPORTATION EXPENSE APPLICABLE TO THE STUDY TRAFFIC (*Conc.*)

	Account	*Group of accounts*	*Independent variable*	*Unadjusted coefficient or unit cost*	*Adjustment factor*	*Adjusted coefficient or unit cost*	*Suptce*	*Total coefficient or unit cost*	*Output units of study traffic*	*Applicable to study traffic*
25	402	Train Other Expenses	Car-Miles	$0.00382			$0.00017	$0.00399	213,831,793	$ 853,189
26			Grain Doors							681,198
27			Train-Miles	$0.09093			$0.00399	$0.09492	3,513,951	$ 333,564
28	404	Signals Operation	Train-Miles (Main Line)	$0.01146	1.06483	$0.01220	$0.00050	$0.01270	2,538,683	$ 32,241
29	390–391	Joint Facilities & Insurance	$ of Transportation Expenses	$0.01206	1.00000	$0.01206	$0.00053	$0.01259	11,261,534	$ 141,783
30	412, 413, 414									
31	418	Loss & Damage—Freight	Direct							$ 307,487
										$11,403,317

[1]The Canadian Pacific estimate has been revised in accordance with the revision of locomotive-miles.

[2]Regression analysis indicated separate coefficients for steam and diesel locomotive-miles. A weighted coefficient was calculated based on the relative number of locomotive-miles for steam and diesel on the Prairie and Pacific Region in 1958.

TABLE VI-d—CANADIAN PACIFIC RAILWAY

ALLOCATION OF TRAFFIC AND GENERAL, COMMUNICATIONS—RAIL, AND TAX (OTHER THAN INCOME TAX) EXPENSE TO MARGINAL COST OF STUDY TRAFFIC

A. Percentage Relationships that Traffic and General, Communications—Rail, Rents and Taxes (other than Income Taxes) is to Total Freight Operating Expense—Year 1958

Traffic and general	12.423%
Communications—rail	1.965%
Rents and taxes	2.819%
Total	17.207%

B. Base Relationship—Variable Cost Study Traffic

Roadway maintenance—marginal	$ 3,737,673
Equipment maintenance—marginal	9,639,908
Transportation—marginal	11,403,317
	$24,780,898

C. Applicable to Study Traffic

Traffic and general	12.423%	$ 3,078,531
Communications—Rail	1.965%	486,945
Rents and taxes	2.819%	698,574
Total	17.207%	$ 4,264,050

TABLE VI-e—CANADIAN PACIFIC RAILWAY

SUMMARY OF ESTIMATED MARGINAL COST OF STUDY TRAFFIC

Roadway maintenance	$ 3,737,673
Equipment maintenance	9,639,908
Transportation	11,403,317
Traffic and general	3,078,531
Communications—rail	486,945
Rents and taxes	698,574
Total	$29,044,948

Chapter 5

The Constant Cost of the Grain Traffic

In Chapter 2 we noted the possibility that some of the costs of railway transportation are fixed. When fixed costs are present, the sum of the marginal costs of all movements will almost never be equal to the total cost. For example, if we are studying the cost of a certain train of ten cars, if the marginal costs of the tenth car is calculated, and if it is applied to each of the ten cars in turn, the sum of these ten marginal costs will seldom equal the total cost. If the average cost can be represented as a curve of the type presented in Chapter 2, Figure 6*b*, that is as falling as output increases from zero to some point and then increasing, the marginal cost will be less than the average cost at outputs between zero and the output of minimum average cost. At outputs greater than that of minimum average cost, the marginal cost will be higher than the average cost.

In Chapter 2 we noted that for individual movements the marginal cost is the bench mark against which the traffic's worth to the railway should be measured. If the output of the railway is such that it (the railway) is operating in that range where average cost is increasing, pricing all movements at the marginal cost will result in profitable operation since all movements will be carried at more than the average cost. If, however, the railway is operating in the range of declining average costs, pricing all movements at the marginal cost will result in losses, since all will be carried at rates below the average cost.

The necessity (if privately owned), or desirability (if publicly owned) of operating a railway in such a manner that it returns at least a normal profit, has led some to believe that railways should base their rates upon average or "fully-distributed" cost. (It is usually assumed that railways are operating in the range of declining costs. Such evidence as we have indicates that this is true for the Canadian railways.) Dr. Ford K. Edwards illustrated this type of pressure. Fortunately the sense of his remarks comes through despite some obvious difficulties in the transcript.

> "One of the reasons I have laboured as hard as I have on the subject of interpreting the fully developed [distributed?] costs is that one of the first studies that came from the ICC on grain was taken by a great many persons who said: 'Now we have no problem on rate-making. Here are the full costs. You don't need your costs of the value of service.' I was immediately thrown on the defensive by the efforts of a great many parties to use them as a guide.

> "Three or four years ago, even the Presidential Advisory Committee on Transportation came out with a statement—with the proposal—that the ICC should have no authority to set rates below fully distributed costs, which is an astonishing thing and got nowhere; but at least it offered this proposal."[1]

Although these pressures are easily understood, they are based on an argument which neglects a very important difficulty. If one considers a railroad which carries only one commodity between one point of origin and one destination, the average cost per ton moved is obviously the total cost divided by the number of tons moved. Similarly the average cost per ton-mile is the total cost divided by the number of ton-miles. There is no need to worry over which definition of average cost is used, as long as revenue on a tonnage basis is a given percentage of cost on a tonnage basis it will hold the same relationship to cost on a ton-mile basis. However, as soon as the situation is complicated by the addition of a second commodity, point of origin or destination, the idea of average cost becomes more difficult, although the mechanical procedure remains the same. The cost can be fully-distributed over the traffic by any of a number of methods. Since the fixed cost is a cost of being in business, it is not attached in any meaningful way to any of the measures by which it may be divided.

Some of the difficulties in choosing a method of distributing these costs were recently given by Mr. Samuel A. Towne, Chief, Cost Finding Section, Bureau of Accounts, Interstate Commerce Commission, who gave five methods of dealing with fixed costs.

> "First, they may be determined as a lump sum. This is of little help to the rate-maker or rate judge because it only shows that [what?] they are in the aggregate.
>
> "Second, they may be added to the out-of-pocket costs on the basis of a dollar distribution. This results in the higher cost traffic being assigned a relatively greater proportion of the constant costs than the lower cost traffic. The fully distributed costs thus obtained give no consideration to demand or non-cost factors, such as competition among modes of transportation, among markets, among commodities, and the value of commodity, social considerations, or any other factors which have played a part in rate-making in the past.
>
> "Third, there are those who raise the question, Why is it not proper to distribute the constant costs on a car and car-mile basis? It has been considered, but we find that, if such a method were used, the light-loading traffic would be asked to share a greater proportion of the total constant costs than the heavy-loading traffic. There is no convincing evidence to indicate that the light-loading traffic can assume this burden.
>
> "Fourth, the revenue dollar has been suggested as a method of distributing the constant costs. Such a procedure introduces revenue into the picture and makes it impossible to establish a standard for measuring rates without the influence of the factor that is being judged. This is wholly undesirable.

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[1] Transcript of evidence, *Hearings,* May 30, 1960, Vol. 71, p. 12640.

> "Fifth, constant costs should be recovered from kinds and classes of traffic based upon their respective abilities to 'bear burden'. This is a characteristic for which there has been little or no measurement data developed. . . . Since this field is almost totally unexplored, we have resorted to a uniform pro-rata apportionment per revenue ton and ton-mile of all carload traffic without distinction whatsoever. Obviously, full costs containing constant costs of this nature cannot serve as a guide to what a rate ought to be but rather they (full costs) become a reference point or norm which measures only differences in direct costs, while ignoring value-of-service measures".[1]

The lack of objective standards by which to choose between differing methods of distributing the fixed cost leads to difficulties illustrated by the hypothetical example of Tables I and II. Table I presents a simplified set of cost and revenue relationships for three movements. Table II shows the variable cost plus the fixed cost distributed according to three different methods.

TABLE I—HYPOTHETICAL EXAMPLE OF COSTS AND REVENUES

	Gross ton-miles of traffic	*Variable cost*	*Revenue*
Commodity A	100	$100	$150
Commodity B	200	250	500
Commodity C	300	275	500
Total	600	$625	$1,150
Fixed Cost	$500	Total Cost $1,125	

[1] Towne, S. A.: *Cost Evaluation and Cost Criteria* in Economic Costing of Railroad Operations, Chicago, Railway Systems and Management Association, 1960, p. 59-60.

Cf. Bonbright, James C.: *Fully Distributed Costs in Utility Rate Making* in American Economic Review, Vol. LI, No. 2, May 1961, p. 306:

> ". . . the question at issue concerns the economic significance of the apportioned total costs, not the weight to be given to a specific cost that must be covered unless the service is to be supplied at an outright loss.
>
> "Mindful, perhaps, of the absence of any convincing answer to this fundamental question and mindful, also, of the notorious disagreements among the experts as to the most rational method of overhead-cost allocation—disagreements which defy resolution in default of any accepted objective standard of rationality—most state commissions have not made full-cost apportionments mandatory as a prelude to a decision on rate structure. Thus, in 1953 and again in 1957, when the Commonwealth Edison Company of Chicago filed an application for a general rate increase, the Illinois Commerce Commission declined to order such an apportionment despite the request of intervenors that the Company be required to submit one. In partial support of its refusal, the Commission referred to an exhibit, introduced by one of the Company officials, disclosing the existence of twenty-nine rival formulas for the allocation of capacity costs alone—formulas each of which had received some professional sponsorship."

TABLE II—FULLY-DISTRIBUTED COSTS OF HYPOTHETICAL EXAMPLE

	Costs Distributing According to		
	Gross ton-miles	*Variable cost*	*Revenue*
Commodity A	$183	$180	$166
Commodity B	417	450	467
Commodity C	525	495	492
Total	$1,125	$1,125	$1,125

In the case of Commodity A, it may reasonably be said from this evidence that the revenue of $150 does not cover the fully-distributed cost. In the case of Commodity B, the revenue of $500 appears to be greater than the fully-distributed cost. In the case of Commodity C, the revenue of $500 is greater or less than the fully-distributed cost, depending upon the measure by which one distributes the cost.

The ambiguities present in this example lead to conclusions similar to those which, in another connection, R. L. Banks has quoted, in modified form, from a statement given by Allan S. Olmstead, 2d, in 1916.

> "These (cost-finding) computations, then, consist of two processes. One is (the determination of variable cost) which is the ascertainment of facts; the other is apportionment (of fixed cost) which is the determination of policy. The former concerns itself with what is; the latter with what should be. One process consists of untwisting the intertwined but distinct strands of particular causation; the other of splitting the homogeneous fibres of a single cost . . . (Variable expense measurement) aims to find what each service costs; (constant cost) apportionment aims to determine what each service *ought to pay*.
>
> "Combining the two figures seems like adding quarts to feet. The desirable course would seem to be to resolve the total "cost" into its constituent elements, one marked "Matter of Fact— . . . (Marginal) Cost of Service" and the other labeled "Matter of Opinion—Mathematical Photograph of Witness's Sense of Justice. . ."[1]

Objections to the simple use of average-cost pricing do not rest solely upon the theoretical ground that the distribution of fixed costs is an exercise in the arbitrary assignment of costs which are not assignable. The practical difficulties which can be encountered can be illustrated by assuming that, in our hypothetical example, the railway lost the transportation of Commodity A. The costs and revenues would then be as in Table III.

[1] Banks, R. L., & Associates: *Study of Cost Structures and Cost Finding Procedures in the Regulated Transportation Industries,* Washington, D.C., 1959, p. 4-17.

TABLE III—REVISED HYPOTHETICAL EXAMPLE OF COSTS AND REVENUES

	Gross ton-miles of traffic	*Variable cost*	*Revenue*
Commodity B	200	$250	$ 500
Commodity C	300	275	500
Total	500	$525	$1,000
Fixed Cost	$500	Total Cost $1,025	

Thus although when revenues are compared with fully-distributed costs, Commodity A appears to be carried at a loss, the railway makes a profit of $25 when Commodity A is carried and a loss of $25 when it is not.

Since the response of the railway to this situation will be to raise the rates on Commodities B and C, average-cost pricing will be to the detriment of the shippers of these commodities. Since, if the railway has correctly estimated the demand for its services, a second result will be lower net revenues than in the situation of Table I, the railway will also be worse off. (See the Note to Chapter 5—A Possible Effect of Differential Pricing.)

The difficulties in the use or attempted use of fully-distributed costs have led many analysts to the belief that it would be better were the fixed costs given only as a lump sum. Regulatory bodies or ratemakers would then be left free to use any method which they wished to devise to cover these costs. Others, who do not feel as strongly, believe that "the rate-maker can ignore *neither* the existence of the constant costs (or burden) nor the necessity of the traffic in question making a proper contribution to such costs. However, the measure of such contribution rests on value-of-service [demand] considerations and not on cost considerations. Any other concept could not be reconciled with the fundamental nature of transportation costs".[1] When this viewpoint is held, the constant costs may be distributed in one or several ways in order to give a point of departure in deciding upon a reasonable rate.

Neither of the railways argued that average-cost pricing should be used for all commodities. Rather, it was argued (by one of the railways) that the transportation of grain to export positions was a special case and that, "if the level of rates set for statutory grain traffic did not recover full cost there would be a burden placed on other traffic or the railways".[2] This view was presented by witnesses through statements such as: "In view of the

[1] Interstate Commerce Commission: *Explanation of Rail Cost Finding Procedures and Principles Relating to the Use of Costs,* Washington, D.C., 1954, p. 21.
[2] Transcript of evidence, *Summations and Arguments,* Vol. 3, p. 99.

large volume of western grain moving to export positions in relation to total traffic, it is apparent that unless a substantial burden were to be placed on other traffic or on the railways, the just and reasonable rate must meet the total cost of transporting the grain traffic."[1] The same witness stated that "no one can seriously suggest that grain traffic in Western Canada bears any resemblance to a mere increment, that is that other traffic provides the basic volume and that grain traffic is incremental".

On cross-examination another witness put the question of basic or incremental traffic differently as is shown in the following interchange.

> "Q. And if you look at the output units per [for?] passenger, they are 10,222,000,000 . . . and I will stop there . . . gross ton-miles, and for grain, 11,768,000,000.
>
> Now, those two output units, to look at, I put it to you that you cannot validly regard passenger as incremental and grain, western grain moving to export positions, as basic to the plan [t]."
>
> "A. Well, that is my position, and I see no reason to change it. Passenger service is incremental or incidental, if you will, because under today's conditions there are alternative modes for transportation of passengers which are being used to an ever-increasing extent."[2]

A slight modification of the answer gives essentially the most common view of the way in which fixed costs are related to rates. As the ICC staff has said: "The apportionment of the constant and joint costs is fundamentally based on a weighing of the effect which the rates themselves would have upon the movement of the traffic and the carriers' revenues."[3]

With this in mind, the quoted evidence on passenger costs might be modified to read: "Passenger service must be considered incremental, or incidental if you will, because under today's conditions attempts to recover any of the fixed costs of the railway will result in alternative modes for the transportation of passengers being used to an ever-increasing extent." Since the railways have not been able to derive even their variable costs from passenger fares, distribution of part of the fixed cost to the passenger service would obviously be of no significance for ratemaking purposes. It would be of use only for certain studies of the extent to which passenger service fails to provide for overhead costs when these are distributed in some consistent fashion. There is nothing in the nature of passenger train service which makes it incremental or incidental. Rather, *management has decided* to treat it as incidental. All the evidence given to the Commission indicates that in making this decision, the railway management reflected properly the facts of the market for passenger service.

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[1] Transcript of evidence, *Hearings*, January 21, 1960, Vol. 21, p. 3409.

[2] Transcript of evidence, *Hearings*, November 8, 1960, Vol. 114, p. 18904.

[3] Interstate Commerce Commission, *op. cit.*, p. 26.

The argument that the grain traffic is "basic to the plant" contains difficulties which can be inferred from the comments on passenger train service. The mere fact that a sizable proportion of the railways' traffic is the movement of grain to export positions has no immediate relevance to the recovery of fixed costs. Suppose that one movement accounts for 60 per cent of a railway's traffic but that competitive conditions, or the ability of the shipper to pay, dictates that while covering something more than the variable costs which can be attributed to it, the traffic under consideration will cease if it is charged with fully-distributed costs (distributed according to any measure). The railway management, realizing that it is better off with the traffic than without it, will consider the traffic as "incremental", just as the managements of the Canadian National and Canadian Pacific consider passenger traffic as incremental.

What of the argument that since the grain traffic is such a large proportion of the railways' business, it must bear "its share" of the fixed costs because the remaining traffic cannot do so. Historically, the fact that the Canadian National has recurrent deficits lends validity to this argument on its behalf. Similarly, the fact that the Canadian Pacific has consistently operated at a profit (although equally consistently below that judged fair and reasonable by the Board of Transport Commissioners), reduces the validity of this argument in its case. But evidence, placed before the Board in application after application for rate increases, shows that as rates have been increased various other categories of traffic have been withdrawn from the railways. It is, therefore, fair to believe that if the grain trade has not borne its full share of the fixed costs (however defined), the attempt to recover these costs from other segments of traffic has resulted in at least the accelerated loss of some of these other segments. Since this causes the distribution of the fixed costs over a smaller total traffic, the problem of the railways is increased in a spiral fashion. But it would be equally fair to reach the same conclusion if the railways were losing other segments of traffic while the grain segment paid its full share, or even two or three times its full share of the fixed costs. For if the railway cannot retain other traffic at higher rates, and if it is possible to obtain needed revenue by having grain return a greater revenue, it is in the interests of the railways to charge grain a higher rate—no matter what proportion of the fixed charges grain is presently contributing. To carry this argument to its ultimate conclusion: if the railway must have increased revenues to exist, and if it is impossible to increase the revenue from other traffic, grain must be charged a sufficient rate to allow the existence of the railway, no matter what multiple of fully-distributed costs that rate may be. Inevitably we are led back to the conclusion that the demand for rail services must be considered in setting a rate for grain, and that the simple, mechanical application of any fully-distributed cost can serve as no more than one guide.

For a certain class of "constant costs", one of the difficulties disappears. These are constants which emerge because a linear model has been used to represent what are, in fact, curved relationships. Suppose that the cost relationships are of the type illustrated by the curve 0A of Figure 1. If a linear model is used, the relationships estimated by the statistical process may be those represented by the line BC. In this case, 0B would be presumed to be a fixed cost.

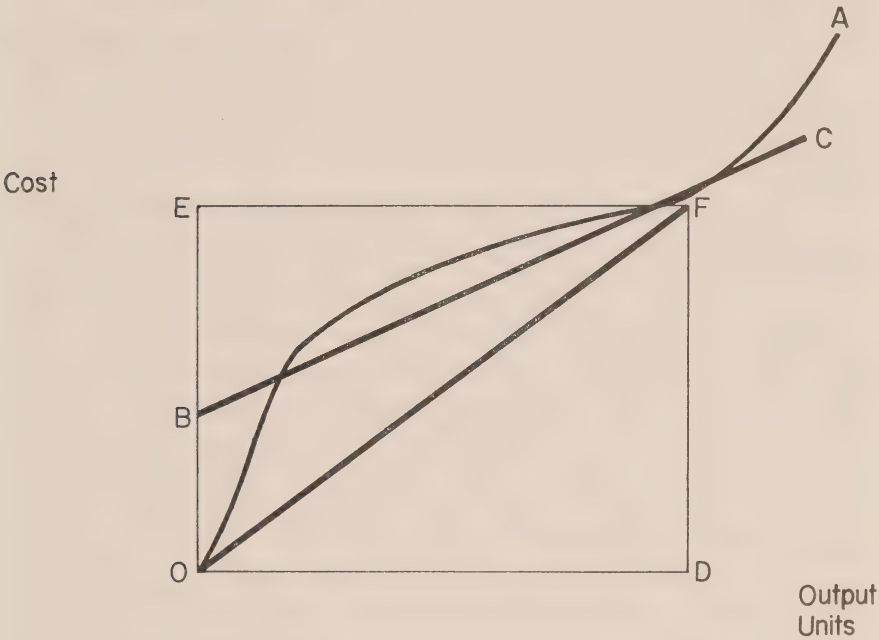

FIGURE 1: Hypothetical Cost Relationships

Of course, 0B is not a true fixed cost since it arises only because the straight line which best fits the data as a whole will not go through the origin. The constant cost so indicated might be referred to as a "pseudo-fixed cost".

In the case of pseudo-fixed costs or in cases when a curvilinear analysis indicates that there are no true fixed costs, one of the basic difficulties in estimating the average cost disappears since there is an average cost which can be related directly to a particular output. If a particular division is operating at an output level, D, the average cost will be represented by the slope of line 0F, that is by 0E divided by 0D. This average cost will be meaningful because it can be attached to a particular output. The use

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to which it can be put still suffers from one of the limitations which affect fully-distributed cost. In the presence of conditions which make it desirable to differentiate the rates for different commodities, the average cost—even if all costs are variable—bears no necessary relationship to a particular commodity or movement. Still, to the extent that average costs of the kind we are now discussing can be computed for a large portion of total railway costs, a more meaningful point of departure will exist for rate regulators than are costs distributed on a completely arbitrary basis.

As the analysis of Chapter 4 indicates, we are not in a position, as yet, to make such an analysis for more than a small proportion of rail costs. However, the analysis which has been made indicates the possibility that the proportion which could be so treated, with further study, might be of significance.

It is to be hoped that later analyses of costs on the Canadian railways will attempt to produce such averages—especially for cases of maximum rate regulation of specific rates. For example, in the case of maintenance-of-way expenditures, examined in Chapter 4, the average and marginal costs for a division with traffic of three billion gross ton-miles are approximately 28 cents and 24 cents respectively. But when the traffic has risen to ten billion gross ton-miles, the average and marginal costs are 19 cents and 5 cents respectively. While the marginal cost remains the relevant cost for minimum rate regulation, it seems evident that, at least in the latter case, the average cost is a more realistic and meaningful point of departure for maximum rate regulation.

If the argument of these pages is accepted, the task of the Commission is not one of estimating the fully-distributed cost of moving grain. Rather it is one of deciding upon a fair contribution which grain should make towards the fixed (or, at any rate, presently unassignable) costs of the railways. It is not the function of this report to make such an assessment. But it may be helpful to the Commission to indicate the extreme positions which might be taken in assessing a fair contribution by grain.

In the absence of subsidies, it can be argued at one extreme that grain need make no contribution to fixed costs whatsoever. If the transport of grain covers the variable costs exactly, the railways are neither better nor worse off carrying grain than they would be if they did not carry grain. Under these circumstances, it cannot be argued that the carriage of grain throws a burden upon anyone. For if the burden were due to the carriage of grain, it could be removed by ending the grain trade. But under the circumstances where all variable costs are met, ending the grain trade will not remove, either from the railway or from any other shippers, any burden.

The difficulty with this point of view is that, to accept it, one must believe that the grain trade is incapable of paying more than the bare variable costs, that all the fixed costs can be borne by other segments of traffic, or that the fixed costs which cannot be borne by other segments of traffic represent costs of portions of the railway plant which are socially unnecessary or undesirable. For, in the long run, many, if not most, fixed costs are escapable with sufficient decreases in output. Hence, an insistence on grain rates which paid only variable costs would see a railway (free to make such decisions) gradually withdraw from the business of hauling grain and making, as time allowed, appropriate reductions in the size of its plant.

At the other extreme, it can be argued that none of these conditions is true. In that case, one would conclude that the transportation of grain to export positions should make a sufficient contribution to bring the railways' earnings up to the point sufficient to keep all their present facilities in existence. In the case of the Canadian Pacific, this would presumably be an amount sufficient to bring earnings into the region of the permissive level established by the Board of Transport Commissioners.

In the absence of subsidy, certain checks might operate to indicate the correctness or otherwise of the assessment made. If the remuneration were set at too low a rate, the railway would attempt to withdraw from service socially desirable portions of lines in an attempt to reduce expenditures. On the other hand, if the remuneration were set at too high a rate, either the shipment of grain will be transferred to highway trucking, or farmers finding that transportation (plus other) costs make grain farming unprofitable will begin to withdraw from grain production. In the latter case, as the railway's net revenues are reduced one would expect it to reduce its rates.

The railways suggested, however, that the increased remuneration should come from the Government as a subsidy to the grain trade. The basis for this suggestion was the statement that to charge an increase in rates to the grain farmers would cause undue hardship to these farmers. Quite obviously there is a sense in which any increase in rates to any shipper constitutes a hardship. No evidence was offered to the Commission to indicate the degree of hardship which would be involved. It is also quite obvious that an attempt to make such an evaluation is not within the scope of this report.[1] But it is within the scope of this report to suggest that the

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[1] Apart from the issue of hardship, no evidence was presented to show the effect which increased freight rates might have upon grain shipments. Evidence for Canada, such as that for the United States of America contained in the United States Department of Agriculture, Technical Bulletin No. 1136, *The Demand and Price Structure for Wheat,* would have contained information which would have helped the Commission evaluate the effects of rate changes upon grain shipments, and consequently the effects upon rail revenues.

adoption of a government subsidy will remove the possibility of one of these checks. There will be no point, other than that at which the resources of the Government itself become over-extended, at which the net revenues of the railways will decrease with an increased rate of remuneration. The upper limit to the subsidy will presumably be decided by the willingness of the country to perpetuate rail lines through this device.

Within these broad limits, the apportionments suggested by the Canadian Pacific Railway and by R. L. Banks and Associates will serve as adequate points of reference on which to base a decision. A short examination of the composition of these estimates is, however, desirable, particularly since such an examination reveals that judgement may be involved even in what appears to be a mechanical application of an apportionment formula.

The Canadian Pacific estimates were derived from the components shown in Table IV. (Columns or rows may not add to the totals shown because of rounding.) Assignment to grain was based upon the ratio of the variable cost of the grain trade to the variable cost of all freight service.

TABLE IV—CANADIAN PACIFIC RAILWAY

COMPOSITION OF CONSTANT COST[1]

	Size related	*Non-size related*	*Total*
Expenditures	$4,900,000	$8,400,000	$13,300,000
Interest	3,000,000	3,700,000	6,700,000
Total	$8,000,000	$12,000,000	$20,100,000

[1] As assigned by the Canadian Pacific.

The amount shown in the column labelled "size related" are amounts which reflect the fact that certain expenditures appear to vary in accordance with changes in the miles of track, or of road, which must be maintained. (The existence of this relationship was discussed in the earlier portion of Chapter 3.) These amounts do not include an allowance for the maintenance of those lines which were labelled "solely-related" or "substantially-related". Costs associated with the substantially-related lines are discussed in Chapter 7.

The Canadian Pacific divided the constant cost in two steps. In the first step, the coefficients for miles of track (found in their regression analyses of road maintenance expenditures) were multiplied by the miles of track in

the system, after excluding the mileage of those lines which had been labelled "solely-related". In the second step, the remaining costs which had not been shown to vary with traffic volume were apportioned.[1]

Underlying this procedure, there would appear to be an argument somewhat as follows: "We have identified the cost of maintaining certain lines as a cost which should be attributed to grain. We will remove the cost of maintaining these lines from further analysis. The remaining costs which do not appear to vary with traffic volume should be apportioned, in some consistent manner, among all the various kinds of traffic."

The method followed by the Canadian National Railways[2] appears to have a different order in the argument underlying it: "Certain expenditures cannot be shown to vary with traffic volume. These expenditures should be apportioned, in some consistent manner, among all the various kinds of traffic. Included, in the costs which will thus be assigned to grain, will be the cost of maintaining certain lines. These maintenance costs have already been attributed to grain. We will, therefore, remove these costs from the mechanical assignment to grain and charge them to grain under a specific label."

If the Canadian Pacific had followed this line of argument, their assignment of constant cost to grain would have been approximately as shown in Table V.

TABLE V—CANADIAN PACIFIC RAILWAY

COMPOSITION OF CONSTANT COST, FIRST REVISION

Expenditures	$10,400,000
Interest	4,600,000
Total	$15,000,000

Still another line of argument might be produced. In the particular circumstances of this traffic, which is not carried further east than the Lakehead, it can be said that there must be many miles of track in Eastern Canada over which none of the traffic being studied is carried. These miles of track could be termed "solely-related to 'non-grain' traffic". Let us suppose that, in the Canadian Pacific system, there are 5,000 miles which could be so designated. Since the maintenance costs of those miles of track

[1] See Exhibits 69 (Revised) and 70 (Revised) in Appendix A.
[2] See Exhibit 57 BBB in Appendix B.

which are substantially related to grain are to be charged to the grain trade, it seems reasonable that the maintenance costs of those miles of track which have no connection with the grain trade should not be charged to the grain trade, even in part. In that case, the apportionment should begin by multiplying the coefficients for miles of track by the number of miles of track in the system, after deducting the miles of track which have been found to be solely- or substantially-related to grain, and after deducting the miles of track which have been found to have no use for the grain trade. In this case, the Canadian Pacific estimates would appear, approximately, as shown in Table VI.

TABLE VI—CANADIAN PACIFIC RAILWAY

COMPOSITION OF CONSTANT COST, SECOND REVISION

	Size related	*Non-size related*	*Total*
Expenditures	$3,600,000	$8,400,000	$12,000,000
Interest	2,250,000	3,700,000	5,950,000
Total	$5,850,000	$12,100,000	$17,950,000

R. L. Banks and Associates, as had the Canadian Pacific, apportioned constant cost in accordance with the ratio of the variable cost of the grain trade to the variable cost of all freight traffic. They, further, presented a number of possible alternative formulations of the appropriate estimate of the total constant cost and of the method of assigning it.

In estimating the total constant cost, Banks first used the constants found in the regression equations as a basis for his calculations. This method was one which had been presented originally by the Canadian Pacific. It was abandoned by the Canadian Pacific when it was found that the total costs estimated in this manner did not equal the recorded total expenditures of the railway for 1958. Among other reasons, this was so because the regression equations were based on the average experience of the three years 1956 to 1958. Total costs estimated with the aid of the regression equations would be expected to equal those recorded for 1958 only if the 1958 experience happened to equal the three-year average experience. Since this was not the case, the Canadian Pacific abandoned its attempts to measure the constant cost by this method. For the same reason, these estimates will not be discussed further here.

The alternate method presented by Banks was also employed by the Canadian Pacific. That is the method, shown in Appendix A, of deducting the identifiable expenses from the total expenditures of the railway and labelling the remainder, "constant cost". In Table VII these apportionments are presented.

As Table VII indicates, Banks also presented alternative assignments based, first, upon the assignment of part of the constant cost to passenger-train service, and, second, without the assignment of any part of the constant cost to passenger-train service. If one were attempting to assess the degree to which the economic difficulties of a railway stem from the inability of certain segments of traffic to contribute income to the same degree as other segments, there would be much to be said for the view that, "those analyses which attach a share of constant cost to the passenger services are of greater validity than those which do not. This follows from the fact that comparisons of like with like—in this case of two allegedly deficit traffics—should be developed and computed in a uniform manner if they are to provide a sound basis for governmental assessment of national transport problems."[1] On the other hand, in a study which attempted to form a basis for a decision on the reasonable level of remuneration for all, or a part of, the freight-train service, it seems unrealistic, as was indicated above, to expect the passenger-train service to contribute to constant costs at the present time. Therefore, one would accept, as more realistic, the apportionments made without assignment to passenger-train service.

Views on the nature of these constant costs will also affect the decision as to whether a part of the constant costs should be apportioned to the passenger-train service. Those believing that the constant costs are true fixed costs will accept the position that no adjustment in the services offered by the railway can affect such costs (except for the drastic adjustment of going out of business entirely). But it may be believed that the great majority of these expenses are of a kind which are not truly fixed, that the level of these expenditures will vary with sufficient long-run adjustment in the railway's operations. In this case, it can be said that the apportionments of "constant" cost are estimates of the level of costs which can be changed with severe changes in the amount of service offered, albeit estimates on a much more approximate basis than those discussed under the heading of "variable cost". If it were believed that large adjustments will be made in passenger-train service in the coming few years one would then lean towards the apportionments which include an assignment to passenger-train service, on the grounds that these indicate the assignment which would be made to grain were the analysis repeated after the modifications in passenger-train service.

[1] Transcript of evidence, *Hearings*, November 10, 1960, Vol. 116, p. 19238.

TABLE VII—CANADIAN PACIFIC RAILWAY

COMPOSITION OF CONSTANT COST[1]

	With assignment to passenger-train service	*Without assignment to passenger-train service*
Non-size related		
Expenditure	$5,016,649	$7,037,995
Interest	1,908,920	2,742,753
Sub-total	$6,925,569	$9,780,748
Size related		
Expenditure	$3,249,967	$4,575,038
Interest	458,355	658,878
Sub-total	$3,708,322	$5,233,916
Totals		
Expenditure	$8,266,616	$11,613,033
Interest	2,367,275	3,401,631
Grand total	$10,633,891	$15,014,664

[1] As assigned by R. L. Banks, see transcript of evidence, *Hearings*, November 10, 1960, Vol. 116, p. 19258-19259.

The assignments of R. L. Banks and Associates differ from those of the Canadian Pacific, even where the same methods of apportionment were followed, because of different estimates of the variable cost, because the costs of certain facilities which are substantially related to certain non-grain services were deducted, and because interest charges were computed on a different basis. The computation of interest charges is discussed in the next chapter. It is sufficient to note, here, that the position taken in this report approximates the interest computations of R. L. Banks.

Finally, it must be noted that a recommendation by the Commission, on the amount of constant cost which should be covered by the remuneration for grain, cannot be considered in isolation from other recommendations made by the Commission. For example, if the permissive level of earnings which is allowed the Canadian Pacific, should remain unchanged, and if the railway should be allowed increased remuneration from various sources sufficient to bring its earnings above the permissive level, the economic pressure on the railway to rid itself of uneconomic services would be removed. At the same time, part of the payment for these services would be transferred from the users of the services to grain shippers. (Since presumably the effect of earnings above the permissive level would be a reduction in other rates.)

In view of the various distributions of constant cost which have been presented above, it seems unlikely that one could claim that an assign-

ment to the grain traffic of $11,000,000 would be inequitable to the grain trade. But if the Commission wishes to direct the attention of the railways and the regulatory authorities to the desirability of effecting economies in other areas, if it is believed that a curtailment of uneconomic light-density lines and passenger services will bring reductions in the total "constant cost", and if it is prepared to recommend measures to cover losses in these last two areas during the period of adjustment, a lower assignment would be justified. An assignment to grain of between $7,000,000 and $11,000,000 would appear reasonable for a short period of years during which the railways were making their initial adjustments in these fields. At the end of that initial period a reassessment should be undertaken, both to estimate the total amount of the "constant cost" and to review the appropriateness of the assignment to the grain traffic.

Examination of the assignments made by the Canadian National Railways, (see Appendix B), indicates that a much higher level of constant cost prevails than is the case for the Canadian Pacific. Insofar as higher costs on the Canadian National represent higher depreciation charges, these higher costs may be a reflection of the conditions under which the Canadian National acquired certain properties. If such be the case, it seems evident that the appropriate remedy would be a review of the accounts of the Canadian National to remove capital charges which may reflect unrealistic prices assessed against the Canadian National at the time various properties were placed in its charge. Insofar as these costs may represent greater difficulty on the part of the publicly-owned road to divest itself of uneconomic lines and services, the appropriate remedy would appear to lie in the direction of equalizing these opportunities. In fact, whatever reason one may think of for these differences, it appears inappropriate that the higher costs should be assessed to the grain traffic. It is, therefore, suggested that upon recommending an amount as an assignment of constant costs for the Canadian Pacific, the Commission recommends an amount for the Canadian National such that the total remuneration (per net ton-mile of grain traffic) recommended is approximately equal to that recommended for the Canadian Pacific.

Note

A Possible Effect of Differential Pricing

The following note is the result of certain statements made before the Commission. Although somewhat remotely connected to the material in the main body of Chapter 5, it derives its *raison d'être* from an assumption which seemed to underlie some of the arguments heard. That assumption was that differential pricing (either between commodities or between

geographic regions) is necessarily against the interests of the shipper who pays the higher rate.

Under certain conditions of demand for transportation, and with a limit to the earnings allowed the railway, this need not be so. Let us take, as an illustration a highly simplified case of a railway which has offered to it only three commodities, which charges rates which always result in a net revenue which can be expressed in an exact number of cents per ton-mile, which has the same costs per ton-mile for each commodity, and which is limited by a regulatory authority to a net revenue of $222. Table I presents a hypothetical demand schedule.

TABLE I—SCHEDULE OF HYPOTHETICAL DEMAND FOR RAIL TRANSPORT

Net revenue per ton-mile	*Ton-miles shipped*		
	Commodity 1	*Commodity 2*	*Commodity 3*
1 cent	4,000	3,000	2,000
2 cents	3,550	2,100	900
3 cents	3,300	1,400	450
4 cents	3,100	1,000	300
5 cents	3,000	700	225
6 cents	2,950	500	185

With these schedules of demand for transportation of the three commodities, the total net revenue available to the railway at various levels of net revenue per ton-mile will be as given in Table II for each of the three commodities.

TABLE II—SCHEDULE OF HYPOTHETICAL RETURNS FROM RAIL TRANSPORT

Net revenue per ton-mile	*Total net revenue in dollars*			
	Commodity 1	*Commodity 2*	*Commodity 3*	*Total*
1 cent	40.00	30.00	20.00	90.00
2 cents	71.00	42.00	18.00	131.00
3 cents	99.00	52.00	13.50	164.50
4 cents	124.00	40.00	12.00	176.00
5 cents	150.00	35.00	11.25	196.25
6 cents	177.00	30.00	11.10	218.10

Under the conditions which are outlined above, the railway would charge a rate sufficient to yield a net revenue of five cents for Commodity 1, three cents for Commodity 2, and one cent for Commodity 3. The total net revenue to the railway would then be ($150+$52+$20) $222. If now

the railway were required to equalize the rates charged these three commodities, it would charge a rate which would yield a net revenue of six cents per ton-mile. The resulting total net revenue would be $218.10. Under the drastic simplifying assumptions which we have adopted in this example, equalization of rates would result in a lowered net revenue to the railway and higher rates to each of the shippers.

Under the complex conditions of Canadian economic life, it is impossible to estimate the extent to which effects such as these occur. If one believes, however, that in negotiating, for example, agreed charges the railways have secured the greatest net revenue that they believe possible, and if they have contracted for freight rates which contribute something to the fixed charges of the railway, one must be very cautious in suggesting that these lower rates are not in fact indirectly beneficial to other shippers who pay higher rates. Equally, there seems reason to question whether, in fact, an enforced equalization of rates between different geographic areas will necessarily redound to the economic benefit of those whose rates are thus lessened. (The case where local shippers are subsidized in order to equalize or lower rates is clearly without the bounds of this argument.)

Chapter 6

The Cost of Money

Regulatory commissions or boards must, in almost all cases, decide what amount of profit it would be proper to allow those companies they regulate to earn. (In this chapter profit will be defined as the difference between revenues on the one hand and operating expenses including taxes on the other.)

One method of determining the amount of profit to be allowed is to ascertain the amount of capital invested in the firm, to decide upon a fair percentage return on the capital invested and where necessary, to translate this into an amount of money. This is known as the "rate base-rate of return" method of determining a fair profit. In determining the rate base, the first decision which must be made is whether to use original value less depreciation (net investment), reproduction value, or some combination of the two. A decision must also be made as to the desirability of allowing a return upon investment upon that part of the plant or equipment which was purchased out of retained earnings. It appears to be generally agreed that investment paid out of retained earnings should be allowed the same return as investment paid from ordinary stock unless the retained earnings were part of an unduly high rate of return. In the latter case, some authorities apparently hold that to allow profit on that part of previous earnings which was above a fair rate of return would be to reward the investor for an earlier unreasonable profit. Following the decisions on the rate-base, a criterion for the fair rate of return must be found.

The greatest difficulty which regulatory bodies have experienced with the rate base-rate of return method appears to have been that after going through the calculations, the allowable earnings resulted, or would have resulted in a rate which was unfair to the shipper or impractical for the railroad. Fair and Williams cite the following causes of the decline of valuation as a principle of rate regulation in the United States.[1]

> " 1. The application of valuation formulae assumed that the railways had such a high degree of monopoly over transportation that an exact regulation of maximum and specific rates could be assured by use of a formula.
>
> 2. The application of a formula failed to take account of the recurrent risks which occurred because of the impact of new competition and repeated economic crises.

[1] Fair, M. L. and Williams, E. W., Jr.: *Economics of Transportation,* New York, Harper and Brothers, Revised Edition, 1959, p. 570-1.

3. Valuation formulae did not take into account the effect of rates on the movement of traffic or the financial needs of the railways.

4. The proponents of valuation erroneously believed that valuation can give a firm and precise formula to evaluate the reasonableness of rates rather than a judgement based upon a set of facts which must be considered in relation to the purpose of the study.

5. Valuation strove for precision at the sacrifice of realism. Hadley pointed out years ago that neither estimates of historical investments nor cost of reproduction with depreciation are values in the economic sense. Rather they are only estimated 'assessments', market value being the only true concept of value."

Similar conclusions were reached by the Royal Commission on Transportation under the chairmanship of the Honourable W. F. A. Turgeon which said:

"The task of the Board in fixing, determining and enforcing just and reasonable rates, involves a duty to both the railways and to the public; the Board must therefore be in a position that will enable it to determine, in so far as possible, the balance which will bring about this desired end. But since economic conditions may be such that different considerations exist under one state of affairs than under another, it is not proper to lay down the priority which should be given to the principles which guide the Board. The Canadian Pacific by its proposed amendment, asks that priority be given to the principle of a fair return on investment; yet experience has shown that such a factor may not be the guiding factor, it may be one which in times of economic depression must give way to other considerations. The procedure of rate making must be left flexible and this flexibility now exists under the Railway Act.

"If the proposed amendment submitted by the Canadian Pacific Railway were adopted it would tend to make the Board mere computers of a rate base and a rate of return, and calculators of the amount of increases necessary to bring about that return. The Board should not be so atrophied. The Board's duty is to consider the justness and reasonableness of rates not only as a whole, but in particular as well. Fair return on property investment may be one of the tests; it must not be either the sole or guiding test."[1]

Like reasoning is evident in the judgement of the Board of Transport Commissioners which said:

"Without purporting to summarize all the reasons previously set out, the following three reasons have particularly influenced us in deciding, as we do, that we will not under existing circumstances adopt the rate base-rate of return method for Canadian Pacific which, within the meaning of this application, would be the sole method of determining a permissive level of rates for all railways in Canada subject to our jurisdiction:

(1) The fundamental nature and nation-wide expense of the railway enterprise in Canada as presently constituted do not lend themselves to an automatic translation of railway costs into rates—both freight

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[1] Royal Commission on Transportation, *Report*, Ottawa, The King's Printer, 1951, p. 70.

and other rates—based on any preconceived return. This inherent factor is in contrast with the single or multi-service local monopolistic utilities . . .

(2) The economic impact of freight rates is such that they should not be made the product of any automatic formula. This is particularly so where 100 per cent of the cost, or the increase in cost, is sought to be automatically applied in general rate increases to a much lesser percentage of the revenue producing business and in particular to that narrowing section of the non-competitive and non-statutory rate structure where the economic leverage and consequences are the greatest.

(3) The expression of net railway earnings as a rate of return encompasses certain component elements over which this Board has little or no direct control. Apart from the policies of government of which taxation is the most readily apparent, the component elements include the following:

(a) fluctuations in traffic both as to volume and consist;

(b) policies and demands of railway labour, and

(c) policies and efficiency of railway management.

We believe it would be both unsound and unrealistic for the Board now to attempt to pre-determine for nation-wide rail transportation any net return which in the end result is only the expression of the effect of the above-noted elements in conjunction with other factors when, in a composite sense, they are beyond the power of any single agency to regulate. We further believe that on psychological grounds alone it would be conducive to a weakening of the barriers, which now at least to some degree hold in check certain costs to create any illusion of a pre-determined net return for nation-wide rail transportation. Furthermore, on similar grounds, it could well be that the term 'financial requirements' would carry the connotation of a more searching scrutiny of all requirements for which funds are necessitated than would the automatic acceptance of the rate base-rate of return method which has been described at times, albeit in error or at least in over simplification, as reducing the Board to mere 'computers'.

In summary, therefore, the Board is of the opinion that, in the long run, it would be disadvantageous to the interests of the public, the railways and investors alike to give, through the implementation at this time of the Canadian Pacific proposal, any appearance or inference of certainty of solution of a nation-wide rail transportation problem for which, under present conditions, no certainty exists."[1]

Rather than use this method the Board has expressed its ruling on the proper level of profit for the Canadian Pacific as the amount of "permissive earnings", a specific amount. To find this amount the Board takes into account all the factors enumerated above. It then expresses its judgement on the amounts which the railway should be permitted to earn to cover payment of interest on bonded indebtedness, dividends or ordinary and

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[1] Board of Transport Commissioners for Canada, *Judgment, Rate Base-Rate of Return,* Judgments, Orders, Regulations and Rulings, Vol. XLVIII, No. 16A, November 15, 1958, Ottawa, Queen's Printer, p. 55-6.

preferred stock, and in addition it includes an amount of "permitted" retained earnings. Calculations using the rate base-rate of return method are used by the Board as *one* of the end checks of permissive earnings. It will be obvious that once the permissive level of earnings has been established, although the route taken is different the end result can be expressed as a "permissive rate of return on net investment".

The cost of money developed by the railways was used by them as a rate of return which was applied to the base of net rail investment in property and equipment devoted to the grain trade. In addition, an amount was computed similarly, based on the unassignable investment. These amounts were presented as a part of the estimated cost of moving grain in 1958. The Canadian Pacific argued that the cost of money and the rate of return are not the same thing. This is correct, and the differences will be marked below. Nevertheless, the procedure followed by the railways was precisely that described by the Honourable Mr. Justice Kearney as the rate base-rate of return method.[1] The only exceptions were the use of the term "cost of money", and the application to the export grain trade alone.

In the light of the discussion above and the similarity in method, we must examine the claims that, the "cost of money is a fact", and that this fact was determined. To justify this contention, the witnesses for one railway argued that "the cost of capital is just as much a cost as the cost of labour", and "the cost of money is similar to the cost of wages". The first of these contentions is the weaker since it simply asserts that the cost of obtaining money for investment is a real cash outflow. The second contention may mean only that, or it may contain the stronger assertion that the cost of money has the same characteristics as wages. If the latter is the proper interpretation of the second contention, and if this contention were correct, there could be no doubt that the figures presented by the railways should be accepted as a component part of the cost of moving grain to export positions. There are, however, important differences which have been overlooked.

The cost of labour is a precisely measurable quantity once the quantity and kind of labour required are known. Present day wage rates are known; past payments of wages are recorded. The cost of money must be estimated. In contrast to a simple statement that the cost of train enginemen, train locomotive fuel and power and trainmen was $6,378,621 for the export grain trade in 1958, some twenty-one pages of text, supported by twenty-four pages of schedules and charts were required to demonstrate the process by which the estimate of 6½ per cent for the cost of money was reached. This is because in the cost estimates, the amounts actually paid to labour were presented at least for the system as a whole. In the case of the cost of money

[1] Board of Transport Commissioners for Canada, *op. cit.*, p. 15.

an attempt was made to estimate the amount which would have to be paid if the Canadian Pacific were to attempt to raise, in the market today, a sum equal to the issued value of its ordinary stock and retained earnings, while continuing to maintain payments on its present debt.

What are historical facts and what can be determined, are the return which the company has obtained on *its* investment and what yield the investor has obtained on *his* investment. For any year, the first of these is simply the sum of the interest paid on bonds, debentures and other debt instruments, the dividends on preferential and ordinary shares, and retained income. Expressed as a percentage, the sum of these is divided by the net investment of the company. The yield to the investor is most usefully defined as the interest or dividend which he receives from his investment. As a percentage it is usually divided by the *market value* of the bonds or shares.[1] Had the actual payments been given (including retained earnings as a "payment" to shareholders) the entry would have been very simply one of dividing net rail income by net rail investment (both recorded figures about which there is no dispute). This figure could have been presented as the historical cost to the railway in 1958 for the capital which it employed.

Instead, the railways chose to present the cost of money in terms of the yield which the railways would have to provide investors in order to attract capital today. This can be estimated but it can only be determined by an attempt to issue new securities; only then can one be certain what in fact a company would have to pay in the way of interest or what price they could obtain for stock when they attempted to raise new capital.

The cost of money at any time is a result of the interaction of the company's return on investment, the yield to investors, the history of both of these and of a host of other factors which can be summed up as "the current attitude of the market". The yield to investors depends upon the return to the company, since the first must be paid out of the second. While it would seem logical that the cost of money would be a reflection of the yield to the investor, this is only true in part. Since some of the return to the company can be retained, the relationship between the return to the company and the yield to the investors is also important. In evaluating corporate bonds a figure frequently quoted is the number of "times interest earned". This figure indicates the ability of the corporation to maintain interest payments in the face of a possible worsening in its fortunes. In the case of ordinary stocks the number of times the dividends have been earned after payment of interest or of dividends with a higher priority is often quoted. The pay-out

[1] Retrospectively, a particular investor may include any capital gains which he has obtained during the life of his investment. Prospectively he may include expected capital gains. Since these will depend upon the period and duration of ownership they are not easily available for quotation.

ratio, that is, the percentage of earnings which was paid out as interest or dividends, indicates the ability of the company to finance growth in investment from internal sources.

In addition to these measurements, the value of ordinary stock is frequently judged by the growth in the company's sales, earnings and investment, by the degree to which growth in investment has been financed by the issuance of ordinary shares (thus reducing the relative participation, in earnings per share, of former owners), the stability of the company or industry—that is its ability to withstand depressions, or to perform better relative to other companies or industries during recessions, even if perhaps not performing relatively as well during periods of high economic activity. The last two are not entirely independent, for if a firm has obtained a high proportion of its capital through debt, the heavy fixed charges will place it in a relatively vulnerable financial position.

Finally there is "the attitude of the market". From time to time investors in general turn to or away from common stocks as a class for a variety of reasons. During the years following World War II, for instance, a trend towards buying common stocks and away from securities with fixed interest was rooted, in part, in the belief that common stocks offered a measure of protection against inflation. It was believed that, in general, the prices and perhaps the yields of common stocks would increase at least in step with the general price level. At the same time, many investors felt that growth was a much more important criterion when evaluating a stock than the current yield. For reasons such as these, many common stocks sold at prices which, in terms of the analysis which would have been performed in the years before World War II, were almost unbelievably high.[1]

Despite the forthright statements in the preceding few paragraphs the estimation of the cost of money is neither simple nor usually completely accurate. Were it so the underwriters of bonds would be able to estimate the selling price to the market which would call forth exactly the amount of subscription desired. But examples are present of subscriptions falling short of offers (under-estimated cost of money) and exceeding desires (over-estimated cost of money). Nor is there complete unanimity in theory on the factors which determine the cost of money. For example, there has been a dispute, on the theoretical level, over the effects of a firm financing by means of different proportions of debt and equity.[2] A recent empirical study of the differences at one point of time in the price earnings ratios of a sample of corporations in the United States concluded that the most

[1] Presumably a particularly wide-spread example of the investors' inclusion of expected capital gains in their evaluation of expected future "yield".

[2] See Rose, J. J., Durand, D., and Modigliani, F., with Miller, M. H.: *The Cost of Capital and the Theory of Investments, Comments and Reply,* in American Economic Review, Vol. XLIX, No. 4, September 1959, p. 628-669.

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important determinants of a low cost of money appeared to be large size and stability of earnings, and also concluded that as far as could be demonstrated from this study, the evidence that the debt-equity ratio was important was inconclusive.[1] This last finding is in direct opposition to one of Durand's given in the last reference.

Notwithstanding these complications, it is certainly true that where earnings per share are low, the cost of money will tend to be high and that with an additional absence of marked growth the cost of money may be very high. As earnings per share increase, the cost of money will decrease to the point where it approximates a "normal profit". Where the return to the company is very high this approximation of normal profit to the investor will be accomplished by an increase in the market price of the securities.

The cost of money differs from the cost of labour in another important respect. If some wages are not paid, the labour which would have been paid will be withdrawn. In the case of some part of the investment, however, even if the cost of money is not paid the investment will not be removed. A part of the investment in railways is composed of the costs of grading the terrain, constructing bridge abutments, building tunnels, and so forth. If the cost of money is not paid on this investment the grading will not be undone nor will the bridge abutments necessarily be destroyed. Furthermore, even if there is no return on investment, that is, if the cost of money is not paid at all, the enterprise may continue to function for an indefinitely long period of time. It is sometimes thought that, because bonded indebtedness carries a fixed interest charge, there is a difference in kind between the obligations of paying dividends on ordinary stock and the obligation to pay interest on bonds. From a legal and accounting point of view this is so. From the point of view of the cost of operations, the difference is merely one of the priority of payment. J. M. Clark has made this point as follows:

> "For our purposes, the chief issue is the true nature of fixed charges, because they are often confused with 'constant costs'. Fixed charges represent a minimum limit on the net earnings of operation below which they cannot go without insolvency. Nevertheless, they frequently do go below this level, with the result that there is a reorganization and the bond holders accept stock in place of part of their bonds, or some other adjustment is made that reduces the fixed charges, and the business goes on. Fixed charges obviously may cover a very large or a very small part of the capital invested. Two companies may have exactly the same investment, but one of them may have two-thirds of its capital covered by fixed obligations and the other may have no fixed obligations at all. For purposes of the financial records, the income account and the balance sheet, there is an important difference between the two cases; but for purposes of cost accounting there is—or should be—none."[2]

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[1] Benishay, H.: *Variability in Earnings—Price Ratios,* American Economic Review. Vol. II, No. 1, March 1961, p. 81-94.

[2] Clark, J. M.: *Studies in the Economics of Overhead Costs,* Chicago, University ot Chicago Press, 1923, p. 46-7.

Although the cost of money is real, it must be concluded that it does not stand on the same footing as the cost of labour or materials because it is not known, except at the moment of appealing to the market, and so cannot be presented with the precision with which wages and the costs of materials can be presented (at least in total). There is, however, another approach which can be fruitful. This approach was taken by another railway witness who defined the cost of money as "the return which should be earned if invested in a similar enterprise". This witness appears to have been alluding to the idea, which was discussed in Chapter 2, of "normal profit". Locklin remarks that "in discussions of economic theory, a return on capital, *or so much of it as is a normal return,* may properly be considered as a cost of production. This is so because capital must in the long run receive its reward, or additional capital will not be forthcoming when needed".[1] (emphasis added). This definition, however, reminds us that the relevant rate to apply where a subsidy is in question is the rate which will be just high enough to encourage the investor, through the railway management, to stay in a business which it is desirable to continue, and which will be just low enough to discourage him from remaining in an undesirable business. To do otherwise would be to reward the company for staying in a socially less than economic business or to fail to reward it fairly for its contribution.

The preceding pages have discussed generally the question of the application of the cost of money. When consideration is given to the application of either the cost of money or a rate of return, some further observations can be made. The investor receives this return from the capital he has invested as a whole, not from each constituent part. In fact, every business carries on activities which require investment but which do not *in themselves* yield a direct return on investment. For example, office space and equipment for advertising and public relations staff is justified, not because these activities in themselves give a return on the capital, but because they increase the possibilities of earning a profit in other activities. In the peculiar circumstances of the export grain traffic, the investment required has similar characteristics. By the terms of the Railway Act, the railways are required to carry grain to export positions at a rate set by statute. As long as the railway as a whole returns a satisfactory yield upon the investment, investors will continue to make additional capital available as needed. Under these conditions the cost of money is indeterminate as far as the grain trade is concerned. In point of fact, the evidence presented by the railways would indicate that, according to this definition, the cost of money for the grain trade was negative in 1958, since they have testified that in their opinion they were required to carry

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[1] Locklin, D. Philip: *Economics of Transportation,* Chicago, Richard D. Irwin Inc., 3rd edition, 1947, p. 135.

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the grain at less than variable cost and have also indicated that, in fact, they did add capital by, for example, changing from steam to diesel locomotives.

In fact, the return on investment which is received from any movement is the residue which is left from the revenues which are received when all the expenses have been paid. It is impossible to determine what, in fact, the return on investment was for any particular segment of a business involving numerous products (for example, transport of many commodities between various pairs of points). To do so one would need to know the contribution of the particular segment to the constant costs of the enterprise. But, this can only be known if the return on investment is known since each of them is taken out of the difference between variable cost and revenue.[1]

For purposes of rate regulation this need not present an insuperable problem. The railroads' procedure can be followed. That is, one can assume a rate of return equal either (a) to what the firm received on its investment as a whole, or (b) what one judges it should have received. This rate can then be applied to the investment which is assignable to the commodity under study. A similar rate of return can be applied to that investment which is not assignable to any particular movement. The resulting amount can be included as a part of the constant costs. But in doing this it should be borne in mind that the resulting figures represent a guide to the proper rate, they do not constitute a rigid formula. Most important, once the rate has been fixed, except where each and every movement bears its fully-distributed cost, it is impossible to say what return is being earned on the investment by any specific segment of traffic.

The Railway Estimates of the Cost of Money

The definition of the cost of money presented to the Commission by the Canadian Pacific Railway witnesses was that:

> "In determining costs of producing a product or service full recognition must be given to the cost of capital or what is sometimes termed 'cost of money'. Such a cost is expressed as a percentage rate on investment and measures the compensation required for the use of capital."

The amounts included in this cost of money were estimated according to these criteria:

> "The cost of debt and preference stock capital is the current cost of servicing that capital which was outstanding on December 31, 1958.
>
> The cost of common or ordinary stock equity capital is what is required to protect the financial integrity of the enterprise and thus permit it to attract such capital on reasonable terms and conditions."

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[1] Cf. the discussion of Chapter 2, p. 201-202.

In order to estimate the cost of equity capital[1] comparisons were made on the yields on market price of 18 railroads in the United States which for the year 1950:

(1) had a gross investment in plant of $300,000,000;

(2) had revenues amounting to $100,000,000 or more;

(3) paid dividends;

and for the Canadian Pacific Railway and 25 railroads for which Moody's publishes group data.

Comparisons were made of the earnings-price ratio, that is the percentage which annual earnings represented of the market price; the yield, that is the percentage which dividends represented of the market price; and the pay-out, that is the percentage which dividends represented of earnings available on stock.[2] Various comparisons were presented for the years 1950-1959. Further comparisons were presented for gas and electric utilities and for manufacturing corporations in the United States and Canada.

As a result of this study Canadian Pacific reached the conclusion that the cost of money for equity capital was between $9\frac{1}{4}$ and $9\frac{1}{2}$ per cent for 1958.

This rate for equity capital and the current rates for debt and preference stock capital were then used to compute a composite cost of capital employed in rail enterprise as shown in Table I.

It will be noted in this table that the rate of $9\frac{1}{4}$-$9\frac{1}{2}$ per cent has been applied to an aggregate amount of capital of $847,107,330 which is the

[1] The argument, before the Commission, on the cost of equity capital was long and detailed. This section discusses at some length various arguments brought forward to support the procedure used by Canadian Pacific. Briefly the error, which I believe Canadian Pacific committed, can be outlined as follows. Canadian Pacific employed the following definitions:

$$\text{Yield} = \frac{\text{Total Dividends Paid}}{\text{Total Market Value of Common Stock}}$$

$$\text{Pay-out Ratio} = \frac{\text{Total Dividends Paid}}{\text{Total Earnings Available}}$$

An average current value of these ratios was then estimated. To estimate the amount of earnings required on investment the yield was multiplied by the reciprocal of the pay-out ratio. This, since

$$\frac{\text{Total Dividends Paid}}{\text{Total Market Value of Common Stock}} \times \frac{\text{Total Earnings Available}}{\text{Total Dividends Paid}} = \frac{\text{Total Earnings Available}}{\text{Total Market Value of Common Stock}}$$

allowed the Canadian Pacific to estimate required earnings on the basis of value of common stock. In fact, however, the Canadian Pacific multiplied these ratios by the value of common stock plus earned surplus. (I am ignoring the difference between the issued and the market values of the stock.) In effect, Canadian Pacific made a double allowance for retained earnings.

[2] The definitions employed in this chapter are those used by the railway witnesses.

amount of ordinary stock and retained earnings. The inclusion of retained earnings in this base was justified by the statement:

> "I make no distinction between the capital raised directly from stockholders through the sale of stock and that raised indirectly through investment of retained earnings, and none can logically be made, in my opinion. Every dollar invested in a diesel locomotive, for instance, is capital which must be compensated. Thus, if the money invested in a diesel locomotive is raised in part through issuance of debt securities, in part through the sale of ordinary stock, and in part through the investment of retained earnings, no distinction can reasonably be made between or among these sources such as to hold that part of the capital involves a cost or sacrifice and the other part is free. In my opinion, it makes absolutely no difference, in determining the cost of capital, whether the capital comes directly from stock sold to stockholders or whether it is derived indirectly from stockholders in the form of retained earnings: the important thing is that the capital is invested in the rail property which is used in the public service."

Undoubtedly, once the investment has been made no distinction can be made between the various sources of capital which are employed by the firm. There is no way of deciding for example that diesel locomotives were paid for by sums raised from one source and that box cars were paid for by sums raised from another. Even in the case of money raised through the issuance of trust certificates, although the immediate transaction includes the hypothecation of equipment which is bought in a literal sense with money loaned upon the trust certificate, other funds are thereby released for different forms of investment. Thus the distinction between the application of funds raised by means of trust certificates and funds raised otherwise is, as far as application is concerned, a formal distinction rather than a real distinction.

Although it is impossible to distinguish between the various sources of funds as far as their use in various applications is concerned, it is not impossible to distinguish between the costs of the various sources. In fact Table I shows that the cost rates applicable to Canadian Pacific, in view of the company, varied from 2.35 to over 9 per cent depending upon the type of security which was issued.

The method employed in Table I assumes that the cost of money for ordinary stock and for retained earnings is the same. Bearing in mind that this amount is defined as ". . . what is required to permit (the firm) to attract such capital on reasonable terms and conditions", we must ask whether in fact it has been necessary for the Canadian Pacific to pay a return on retained earnings of the same amount as that paid on ordinary stock. It is obvious that this is not so. By definition, retained earnings are not raised in the financial market. They result from the operations of the firm. Therefore no return has to be paid on them in order to obtain them. What is true, is

TABLE I—CANADIAN PACIFIC RAILWAY

COMPOSITE COST OF CAPITAL EMPLOYED IN RAIL ENTERPRISE AT DECEMBER 31, 1958

		Aggregate Amount	*Percent of Total*	*Cost* Rate*	*Weighted Cost Rate*	
1	Equipment Trust Certificates					1
2	U.S. Currency	$ 16,092,814	1.12	3.72%	.04%	2
3	Canadian Currency	39,743,414	2.76	4.10	.11	3
4	Leased Lines Securities—					4
5	Not owned					5
6	Sterling	$ 49,119,186	3.41	2.52	.09	6
7	U.S. Currency	175,300	.01	5.82	—	7
8	Other	11,314,122	.79	3.12	.02	8
9	Collateral Trust Bonds	$ 125,969,177	8.74	4.36	.38	9
10	Perpetual 4% Consolidated					10
11	Debenture Stock					11
12	Sterling	$ 184,635,859	12.82	2.35	.30	12
13	U.S. Currency	44,617,168	3.10	4.83	.15	13
14	Total Debt	$ 471,667,040	32.75	3.33	1.09	14
15	Preference Stock	$ 121,375,308	8.43	2.53	.21	15
16	Ordinary Stock and					16
17	Retained Earnings	$ 847,107,330	58.82	9.25–9.50	5.44–5.58	17
18	Total Capital	$1,440,149,678	100.00%			18
19	Composite Cost Rate				6.74–6.88%	19

*Reflects reductions in cost on account of exchange rates.

SOURCE: Exhibit 75, submitted by Canadian Pacific Railway to the Royal Commission on Transportation, December 17, 1959.

that if the company does not pay a satisfactory dividend on its ordinary stock, the owners of that stock will become dissatisfied and may refuse to permit the retention of earnings.

TABLE II—MANITOBA AND ALBERTA

RATE OF INTERNAL FINANCING, CANADIAN PACIFIC RAILWAY PERCENTAGES OF TOTAL CAPITAL REQUIREMENTS FINANCED BY DEPRECIATION CHARGES AND RETAINED NET EARNINGS

Date	*Total Capital Requirements*	*Depreciation Charges*	*Retained Earnings*	*Total Internal Financing*	*External Financing*
1884–1894	100	0	0	0	100.0
1895–1904	100	0.5	14.4	14.9	85.1
1905–1914	100	0.3	19.2	19.5	80.5
1915–1919	100	0.7	64.0	64.7	35.3
1920–1929	100	6.0	11.1	17.1	82.9
1930–1939	100	12.5	75.1	87.6	12.4
1940–1946	100	47.8	52.2	100.0	0
1947–1956	100	53.8	33.0	86.8	13.2
1957–1959	100	53.6	34.0	87.6	12.4

SOURCE: 1884–1956 derived from a study of the Source and Application of Funds prepared and filed with the Board of Transport Commissioners by Riddell, Stead, Graham & Hutchison, Chartered Accountants; 1957–59 derived from a similar study prepared by Peat, Marwick, Mitchell & Co., Chartered Accountants.

Quoted by witness M. J. Ulmer, transcript of evidence, *Hearings*, November 9, 1960, Vol. 115, p. 19071.

TABLE III

RATE OF INTERNAL FINANCING, CANADIAN PACIFIC RAILWAY PERCENTAGES OF NEW CAPITAL REQUIREMENTS FINANCED BY RETAINED NET EARNINGS AND EXTERNAL FINANCING

Date	*Retained Earnings*	*External Financing*
1884–1894	0	100.0
1895–1904	14.5	85.5
1905–1914	19.3	80.7
1915–1919	64.5	35.5
1920–1929	11.8	88.2
1930–1939	85.8	14.2
1940–1946	100.0	0
1947–1956	71.4	28.6
1957–1959	73.3	26.7

This point is of particular importance when a historical argument is presented. Table II shows the extent to which the Canadian Pacific Railway has been able to obtain its total capital requirements from internal financing. Since the meaning of "what is required to protect the financial integrity of the enterprise" is, presumably what is required to maintain the capital value of the enterprise, Table III shows an adaption of part of Table II, to estimate the rate of internal financing of new capital requirements. It will be seen that in terms of the definitions above, Canadian Pacific has been able to obtain an important portion of its needed capital without contracting to pay any additional cost.

None of the foregoing argument contradicts the claim that compensation must be paid the shareholders for every dollar raised from them whether "directly . . . . through the sale of stock" or "indirectly through investment of retained earnings". In fact they obtain the same return for either kind of investment. But for different purposes it may be more convenient to present this return as percentages of different bases. For example, according to the Annual Report for 1958 of the Canadian Pacific Railway Company, the dividends declared on ordinary stock of an issued value of $355,294,575 were $21,217,963. This amounts to a yield of 5.97 per cent. Table IV presents a comparison based on market price for the years 1950-1959. For purposes of evaluating the yield from the viewpoint of the present day investor, interested in comparing his likely profit from a purchase of

TABLE IV

YIELDS ON CANADIAN PACIFIC ORDINARY STOCK

Year	*Yield*
	%
1950	7.23
1951	6.21
1952	4.16
1953	5.45
1954	5.52
1955	4.71
1956	4.47
1957	6.09
1958	5.71
1959 (September)	5.56

SOURCE: Exhibit 75, Schedule 9, submitted by Canadian Pacific Railway to the Royal Commission on Transportation, December 17, 1959. (Testimony of Mr. C. W. Smith)

Canadian Pacific ordinary stock with that which might be obtained from purchase of another stock, the data of Table IV is appropriate. If one is interested in the cash return which an original investor would receive today on the cost of his original investment, the figure of 5.97 per cent is appropriate. If, however, one wishes to know the yield which investors in common stock obtain on the amounts which they have paid into the company treasury either directly through the purchase of ordinary stock upon original issue, or indirectly through retained earnings, then the appropriate calculation is to express the dividends of $21,217,963 as a percentage of the sum of the issued value of ordinary stock and of retained earnings, that is of $847,107,330. This calculation results in a yield of 2.1 per cent. Thus it can be seen that the method used by Canadian Pacific to obtain an estimate in current terms is equivalent to equating a yield which historically has been in the region of 6 per cent with one which has historically been in the region of 2 per cent. Had the Canadian Pacific, in developing its composite cost of capital, applied the rate of 9¼-9½ per cent to the base upon which it calculated the rate, that is the direct payments for ordinary shares, lines 16 to 19 of Table I would have appeared as follows:

	Aggregate Amount	*Per Cent of Total*	*Cost Rate*	*Weighted Cost Rate*
16 Ordinary Shares	$ 355,294,575	24.67	9.25–9.60%	2.28–3.24
17 Retained Earnings	491,812,755	34.15	0	0
18 Total Capital	$1,440,149,678	100.00%		
19 Composite Cost Rate				3.58–4.54%

It should be understood, of course, that the cost rate of zero indicated for retained earnings does not imply that in fact no return was earned or paid on this capital but rather that, as has been argued above, the return paid on retained earnings is included in the computation of yield on ordinary shares.

The proposal of the Canadian Pacific is not that the dividends paid on ordinary shares should be at the rate of 9¼-9½ per cent. Rather it was proposed that the dividends should be approximately 6 per cent and that the pay-out ratio should be between 60 and 65 per cent. If the method used by Canadian Pacific was not adopted in error, it contains at least one of three assumptions, none of which has been stated. These are:

(a) that the pay-out ratio will be changed to approximately 30 per cent;

(b) that the dividend rate will be increased beyond 6 per cent; or

(c) that the market price of Canadian Pacific ordinary stock will rise sharply.

This can be seen by examining what would in fact happen if the Canadian Pacific method were followed. The following three examples assume in each case that two of the assumptions listed above are not true.

Example 1:

Assumes that neither the dividend rate nor the market price increases.

(1) Earnings	=	847,107,330 × 9.25	= 78,357,428
(2) Dividends	=	355,294,575 × .06	= 21,317,674
(3) Retained Earnings	=	Line 1 — Line 2	= 57,039,754
(4) Pay-out	=	Line 2 ÷ Line 1	= 27.2%

Example 2:

Assumes that the pay-out ratio is unchanged and that the market price is unchanged.

(1) Earnings	=	847,107,330 × 9.25	= 78,357,428
(2) Dividends	=	78,357,428 × .6	= 47,014,457
(3) Market Value	=	$25.00 × 14,211,783	=355,294,575
(4) Dividend Rate	=	Line 2 ÷ Line 3	= 13.23%

Example 3:

Assumes that the pay-out ratio is unchanged and that the dividend rate is unchanged.

(1) Earnings	=	847,107,330 × 9.25	= 78,357,428
(2) Dividends	=	78,357,428 × .6	= 47,014,457
(3) Dividend Rate	=	6% of Market Price	
(4) Market Value	=	Line 2 × 100/6	=783,574,283
(5) Market Price	=	783,574,283 ÷ 14,211,783	= $55.14

If the Canadian Pacific scheme were followed, but the rates were computed upon the base of investment in ordinary stock (excluding retained earnings) dividends would amount to slightly over $21,000,000 and retained earnings to slightly over $14,000,000. This may be compared to the amounts included in the Board of Transport Commissioners' requirements formula for 1958, under the categories of dividends and surplus. (See Table V.) In the latter case dividends include dividends on preference stock of approximately $3,000,000. (See Table I.)

TABLE V—CANADIAN PACIFIC RAILWAY

REQUIRED EARNINGS ON BASIS OF REQUIREMENTS FORMULA OF THE BOARD OF TRANSPORT COMMISSIONERS FOR CANADA

	1958
Fixed Charges	15,581,000
Dividends	20,620,000
Surplus	15,235,000
Allowance account transfer of non-rail assets to rail	2,400,000
Total	53,836,000

SOURCE: Board of Transport Commissioners for Canada: Judgment and Order, File No. 48771, November 17, 1958, p. 31, Appendix, p.v., Exhibit 58-30.

Table VI restates the cost of money to the Canadian Pacific Railway after the adjustment outlined above and in form similar to the requirements formula of the Board of Transport Commissioners.

TABLE VI—CANADIAN PACIFIC RAILWAY

ADJUSTED COST OF CAPITAL

	1958
Fixed Charges	15,840,000
Dividends	24,388,469
Surplus	12,790,604
Allowance account transfer of non-rail assets to rail	2,400,000
Total	55,418,620

Based upon an investment of $1,440,149,678 this indicates a cost of money of 3.85 per cent, after income taxes. In contrast, the requirements formula indicates a cost of money of 3.74 per cent, after income taxes.

The presentation of Canadian National is shown as Table VII. Two adjustments have been made in these figures as presented by the CNR. The revised figures are presented as Table VIII. The first adjustment has been to remove the 4 per cent Preferred Stock from the pool of Shareholders' Equity to its own category. The rate charged on this stock has then been changed from 9¼ to 4 per cent. There appears to be no clear indication

TABLE VII—CANADIAN NATIONAL RAILWAYS

COMPOSITE COST OF CAPITAL EMPLOYED, AT DECEMBER 31, 1958

	Principal Outstanding		*Debt-Equity Ratio*	*Interest and Amortization*		
	December 31, 1958			*Annual Amount*		*Rate*
LONG TERM DEBT						
Bonds, Debentures and Equipment Obligations	$1,033,808,970			$35,777,824		
Less: Debt Incurred for Investment in TCA	11,056,977	1,022,751,993		409,006	35,368,818	3.458%
Government of Canada Loans and Debenture	484,791,699					
Less: Transferred to Equity	116,988,091					
	367,803,608			18,757,985		
Less: Loans in Respect of Investment in TCA	56,600,000	311,203,608		2,886,600	15,871,385	5.10 %
TOTAL LONG TERM DEBT		1,333,955,601	42.5		51,240,203	3.841%
SHAREHOLDERS' EQUITY						
6,000,000 Shares NPV Capital Stock—CNR	389,518,135					
Less: Capital Stock Issued for Investment in TCA	1,400,000	388,118,135				
882,320,571 Shares 4% Preferred Stock—CNR	882,320,571					
Less: Capital Stock Issued for Investment in TCA	19,043,023	863,277,548				
Capital Investment in Canadian Government Railways		432,549,139				
Capital Stock of Sub. Companies Owned by Public		4,504,203				
Transferred from Long Term Debt						
Debenture—Capital Revision Act 1952	100,000,000					
Can. Govt. Rlys.—Advances for Working Capital	16,988,091	116,988,091				
TOTAL SHAREHOLDERS' EQUITY		1,805,437,116	57.5		167,002,933	9.25 %
TOTAL LONG TERM DEBT AND SHAREHOLDERS' EQUITY		3,139,392,717	100.		218,243,136	6.95 %

Statement N.A.-1

SOURCE: Exhibit 76A, submitted by Canadian National Railways to the Royal Commission on Transportation, December 17, 1959.

TABLE VIII—CANADIAN NATIONAL RAILWAYS

REVISED COMPOSITE COST OF CAPITAL EMPLOYED AT DECEMBER 31, 1958

	Principal outstanding		*Per cent of total*	*Interest and amortization*		
	December 31, 1958			*Annual amount*		*Rate*
LONG TERM DEBT						
Bonds, Debentures and Equipment Obligations	$1,033,808,970			$35,777,824		
Less: Debt Incurred for Investment in TCA	11,056,977	1,022,751,993		409,006	35,368,818	3.458%
Government of Canada Loans and Debenture	484,791,699					
Less: Transferred to Equity	116,988,091					
	367,803,608			18,757,985		
Less: Loans in Respect of Investment in TCA	56,600,000	311,203,608		2,886,600	15,871,385	5.10 %
Total Long Term Debt		1,333,955,601	42.5		51,240,203	3.841
PREFERRED STOCK						
882,320,571 Shares 4% Preferred Stock—CNR	882,320,571					
Less: Capital Stock Issued for Investment in TCA	19,043,023	863,277,548	27.5		34,531,102	
ORDINARY STOCK						
6,000,000 Shares NPV Capital Stock—CNR	389,518,135					
Less: Capital Stock Issued for Investment in TCA	1,400,000	388,118,135				
Capital Investment in Canadian Government Railways		432,549,139				
Capital Stock of Sub. Companies Owned by Public		4,504,203				
Transferred from Long Term Debt						
Debenture—Capital Revision Act 1952	100,000,000					
Can. Govt. Rlys.—Advances for Working Capital	16,988,091	116,988,091				
Total Shareholders' Equity		942,159,568	30.0		87,497,600	6.00 %
TOTAL LONG TERM DEBT AND SHAREHOLDERS' EQUITY		3,139,392,717	100.0		173,268,905	5.52 %

TABLE IX—CANADIAN PACIFIC RAILWAY

INTEREST ON ("MARGINAL") INVESTMENT IN ROAD PROPERTY AND EQUIPMENT APPLICABLE TO STUDY TRAFFIC AT RECOMMENDED RATE

	Investment category	*Output unit*	*Interest per unit*	*Output units of study traffic*	*Applicable to study traffic*	
1	Road Property	Gross Ton-Miles	$0.16488	12,233,795	$2,017,108	
2		Yard and Train				
3		Switching Miles	0.47899	828,054	396,630	$2,413,738
4	Diesel Yard Locomotives	Yard Engine Miles	0.14693	600,527	88,235	
5	Diesel Road Locomotives	Train-Miles	0.17526	3,513,951	615,855	
6		Train Switching Miles	0.13509	227,527	30,737	
7	Steam Locomotives	Train-Miles	0.02446	3,513,951	85,951	
8		Yard Switching Miles	0.03451	600,527	20,724	
9		Train Switching Miles	0.10818	227,527	24,614	
10	Freight Train Cars	Car-Days	0.56997	4,189,930	2,388,134	
11	Work Equipment	Gross Ton-Miles	0.00448	12,233,795	54,807	
12	Shop and Power Plant Machinery	Train-Miles	0.01695	3,513,951	59,561	3,368,618
13						5,782,356

that after receipt of 4 per cent of this stock, the shareholder is entitled to participate further in company earnings. In the absence of such a clear indication it has been assumed that there will not be such participation. The second adjustment has been to remove from the portion claimed as return on the remaining equity, that part which is designed to allow retained earnings. Canadian National is not allowed to retain earnings, therefore it does not seem necessary to make provision for them. These adjustments result in a composite cost of capital of 5.52 per cent for the Canadian National.

This approach amounts to an attempt to place the Canadian National upon a basis similar to that of a corporation which is not owned by the Government. The fact is, however, that the Canadian National is owned by the Government. Whether the money invested in the CNR is raised by the railway directly or indirectly through the Government, the fact is that the money raised is guaranteed by the Dominion of Canada. The cost rate applicable is therefore the cost rate applicable to Dominion of Canada long-term bonds. As the first section of Table VII shows this rate has been of the order of 3.8 per cent.

I recommend that the Commission, in considering the appropriate rate for grain, utilize a rate of 3.74 per cent, after income taxes, in the case of the Canadian Pacific, and 3.8 per cent in the case of the Canadian National. This recommendation contains no judgement on the interest which either railway would have to pay were it to seek additional capital. Should the Canadian Pacific, for example, attempt to raise additional capital and should it be forced to pay seven per cent upon that additional capital, one would expect that the Board of Transport Commissioners would reassess the permissive level of earnings. This recommendation merely reflects the belief of the author that the rate of return used in considering an appropriate rate for grain should not differ from the rate used in considering railway operations generally, and the belief that to criticize the permissive level of earnings set by the Board would fall without the Terms of Reference of this Report.

Chapter 7

Substantially-Related Lines

Each service offered or line operated by a railway serves a partially separate market. The task of analysing the effect of a change of rates, or the abandonment of service on a line, on each of these thousands of markets would be herculean. Therefore, when rates are being considered, it is usual to assume that the present services and lines will be continued. Those costs of maintenance of track and road property which can be associated with miles of track are considered to be fixed costs.

In their presentations to the Commission, the railways departed from the practice of assuming that these road maintenance costs are fixed. Instead, they included, as part of their estimates of the variable cost of transporting grain, an amount to cover the cost of maintaining certain lines which they labelled "solely-related" to the grain trade. It was asserted that these facilities are in existence only to serve the grain trade, and that, therefore, for these lines, the grain trade should bear those costs of maintenance variable with size of plant, the taxes on this plant, depreciation and the cost of money.

Three tests were employed by the railways to identify the solely-related lines. The first test was an examination of the traffic carried to ensure that it was preponderantly grain; the second was an examination of the particular company's rail system to ensure that the remaining system would be viable if the particular lines in question were to be abandoned; the third was an economic test.

The economic test employed by the Canadian National was to find whether the net incremental return, that is the incremental revenues (for this purpose 50 per cent of the revenue was assumed necessary to meet the costs of transportation on the main line), less the incremental costs, were negative for non-grain traffic. Costs variable with output and with size of plant were both included in these incremental costs. If the net incremental return was negative, the line was said to be solely-related.

The Canadian Pacific, as their economic test, determined whether the incremental cost of the branch line non-grain traffic (both branch and main line non-grain costs), plus the maintenance expense which could be attributed directly to the existence of the miles of branch line track, was less than the total revenue from the branch non-grain traffic. The Canadian Pacific argued that: "Where non-grain revenues less incremental costs exceeded the size associated costs the line would have been economic to build if grain were not

handled. Where the revenue fell short of these costs . . . the line would not have been economic if grain were not handled."[1] As a check the Canadian Pacific also employed the test used by Canadian National.

The economic tests applied by the railways suffer from a grave defect. If the revenues from the grain traffic are sufficiently low, and the burden of the railways' argument was that they are sufficiently low, one could show that most of those lines were solely-related to non-grain traffic by a simple reversal of terms. For example, the Canadian Pacific argument could be re-stated to read: "Where the grain revenues less incremental costs exceeded the size associated costs the line would have been economic to build if non-grain traffic were not handled. Where the revenue fell short of these costs the line would not have been economic if non-grain traffic were not handled." Thus, based on the same figures, and with the same form of argument, one could argue that certain lines were both solely-related to grain traffic and solely-related to non-grain traffic.

The first test which the railways applied, that the traffic over the line in question must be preponderantly grain traffic, does not give justification for the use of the term "solely-related". Other products were in fact carried over these lines.[2] General semanticists have pointed out for many years there is a constant danger that the characteristics implied by a label will be attributed to the thing or action labelled, whether or not these characteristics do, in fact, apply to the thing or action. In the present case, the use of the label "solely-related" implies that the facilities being examined are of use only to the grain trade. If this implication is accepted, it follows that the maintenance of these facilities is a charge which should be borne by the grain traffic. Since traffic other than grain is carried on these lines, they cannot be, with strict definition, labelled "solely-related". The term "substantially-related" suggested by R. L. Banks and Associates appears more suitable.

The extent to which the costs of maintaining these substantially-related lines should be borne by one particular class of traffic must be decided in accordance with considerations similar to those discussed in Chapter 5, "The Constant Costs of the Grain Traffic". The fact that a high proportion of the traffic carried on these lines is grain does not, in itself, mean that grain must carry the cost of maintaining the lines. But if the contribution of other traffic, to the cost of maintaining the line, cannot be raised, then (a) the contribution of grain must be raised, (b) the line must be abandoned or (c) the line must be subsidized.

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[1] Transcript of evidence, *Hearings,* December 15, 1959, Vol. 18, p. 2559. Similar comments by the Canadian National can be found in Vol. 17, p. 2372.

[2] The Canadian Pacific said that the weighted average of grain to total traffic on the set of solely-related lines was 82.4 per cent. Transcript of evidence, *Hearings,* December 15, 1959, Vol. 18, p. 2563. The Canadian National said that in all cases the revenue ton-miles for grain were 70 per cent of those for all traffic. Transcript of evidence, *Hearings,* December 14, 1959, Vol. 17, p. 2379.

The last two of these possible solutions are especially important in view of the claims, heard by the Commission, that the existence of light-density lines is a greater problem to the railways than is the remuneration which is received from the transport of grain. Two exhibits, submitted by the railways at the request of the Commission, support the view that the existence of light-density lines is, indeed, a major problem of the railways. These exhibits (reproduced at the end of this chapter) indicate that, even if all the costs estimated by the railways were covered by revenues from the grain traffic, some of the substantially-related lines would remain unprofitable. At rate levels intermediate between those presently in force and those requested by the railways, still more lines were shown as unprofitable. These exhibits cast doubt on the proposition that all of the substantially-related mileage can be viewed as "used and useful" in any realistic sense. Until it has been shown that these lines are in fact necessary to the grain trade, it does not seem reasonable to include the costs of their maintenance among the variable costs of the grain traffic. Once it has been shown that particular rail lines do, in fact, remain in existence because of the grain trade, it seems clear that the grain traffic should bear the primary responsibility of making these lines economically viable. At such a time, the cost of maintaining these lines should be considered as a cost of transporting grain.

It is therefore recommended that the Commission make no provision for including the cost of maintaining substantially-related lines in the estimated cost of transporting grain. Rather, it is suggested that the problem of light-density lines be met as a problem of light density. The necessity of continuing each of the light-density lines should be examined. In doing this, where it is possible to do so (and the railways have demonstrated the possibility at least in the case of lines substantially devoted to grain), the method utilizing the entire revenue from the line in order to judge its profitability is much preferable to the more usual method of attributing one-half of the revenue to the line. The former method indicates clearly whether or not the line makes any contribution to the maintenance of the railway as a whole.

During some interim period, it may be desirable to aid the railways to continue unprofitable lines until a final adjustment has been made; either in the mileage operated or in the rates for the goods carried.

Since there is no way in which the Commission can now know the unprofitable lines of the entire Canadian railway system some criterion of estimation—such as the mileage below a set density—will have to be used as an aid. Similarly, some arbitrary figure for maintenance costs will have to be used in order to estimate the costs of light-density lines. The analysis of Chapter 4 indicates that the road property maintenance costs per mile will vary from division to division. Thus it is necessary to know the division in which the line is operating in order to estimate the costs. In lieu of this, it is

recommended that the Commission use the linear estimates of the railways as its estimate of per mile cost in order to reach a reasonable conclusion on the cost of maintaining light-density lines.

Because of the approximations which must be made, it is suggested, that the Commission make any recommendations for assistance to the railways, in the area of light-density lines in terms of a maximum subsidy, with the proviso that the actual subsidy shall be the loss sustained by the railways on lines which they have proven to be uneconomic. For purposes of computing this maximum subsidy it is recommended that the cost of operating light-density lines be set at $1,500 per mile per year.

Exhibit No. 144

Request of Mr. Geo. Cumming, Vol. 69, p. 12346

CANADIAN PACIFIC RAILWAY

SOLELY RELATED BRANCH LINES WHICH WOULD REMAIN UNECONOMIC AT VARIOUS STATED AVERAGE REVENUES PER TON MILE FOR GRAIN AND GRAIN PRODUCTS

0.75¢ per Revenue Ton Mile			0.90¢ per Revenue Ton Mile			1.00¢ per Revenue Ton Mile		
Subdivision	Date of Construction	Mileage	Subdivision	Date of Construction	Mileage	Subdivision	Date of Construction	Mileage
Alida	1902–1912	53.9	Alida	1902–1912	53.9	—	—	—
Boissevain	1911–1913	35.5	—	—	—	—	—	—
Cassils	1928	23.2	Cassils	1928	23.2	Cassils	1928	23.2
Colony	1931	24.6	Colony	1931	24.6	—	—	—
Lorraine	1915	11.4	Lorraine	1915	11.4	—	—	—
McAuley	1904	16.8	McAuley	1904	16.8	McAuley	1904	16.8
Medstead	1931	36.0	Medstead	1931	36.0	Medstead	1931	36.0
Miniota	1888–1900	43.8	—	—	—	—	—	—
Rapid City	1886–1889	35.0*	Rapid City	1886–1889	35.0	—	—	—
Reston	1906–1908	122.4	Reston	1906–1908	122.4	—	—	—
Snowflake-Fallison	1900–1903, 1908–1909	41.6	Snowflake-Fallison	1900–1903, 1908–1909	41.6	Snowflake-Fallison	1900–1903, 1908–1909	41.6
Varcoe	1889–1906	55.5	Varcoe	1889–1906	55.5	Varcoe	1889–1906	55.5
Woolford	Raley-Woolford, 1905		Woolford	Raley-Woolford, 1905		—	—	—
	Woolford-Wiskey Gap, 1929	20.4		Woolford-Wiskey Gap, 1929	20.4			

*Forrest to Minnedosa only.

Exhibit No. 151

Request of Mr. Geo. Cumming, Vol. 75, p. 13196

CANADIAN NATIONAL RAILWAYS

SOLELY RELATED BRANCH LINES WHICH WOULD REMAIN UNECONOMIC AT VARIOUS STATED AVERAGE REVENUES PER TON MILE FOR GRAIN AND GRAIN PRODUCTS

	Revenue Per Ton Mile		
Subdivision	*0.75¢ Mileage*	*0.90¢ Mileage*	*1.00¢ Mileage*
Amiens	75.0	75.0	75.0
Bengough	71.5	—	—
Blewett	20.9	20.9	20.9
Carberry (Petrel Jct.–Carberry Jct.)	9.9	9.9	9.9
Conquest	59.3	59.3	59.3
Corning	22.3	—	—
Cutknife	43.8	43.8	43.8
Demay	25.0	25.0	25.0
Endiang	75.2	75.2	75.2
Goodwater	26.8	26.8	26.8
Haight	21.6	21.6	21.6
Harte (Pacific Jct.–East Tower)	46.6	46.6	46.6
Hartney	91.4	—	—
Hatherleigh	31.6	91.4	91.4
Kingman	23.4	23.4	23.4
Lewvan	116.8	—	—
Main Center	48.6	—	—
Meskanaw	91.4	91.4	91.4
Miami	62.1	—	—
Neepawa (Rossburn Jct.–Neepawa Jct.)	32.8	32.8	32.8
Pleasant Point (Brandon Jct.–West Tower)	51.7	51.7	51.7
Porter	48.2	48.2	48.2
Rapid City	74.4	74.4	74.4
Rhein	37.8	37.8	—
Robinhood	101.5	101.5	101.5
Spondin	17.7	17.7	17.7
Wakopa	79.9	79.9	79.9
Wawanesa	37.5	37.5	37.5
Total Mileage	1,444.7	1,032.0	994.2
Total No. Subdivisions	28	22	21

Costs and Statistics Branch, Montreal, August 31st, 1960.

Chapter 8

The Costs of Passenger-Train Service

The costs of passenger-train service presented by the railways were based upon the studies which are examined in detail in the previous chapters. Some of the problems of costing passenger-train service are less difficult than those of the grain trade since some classes of expenditures are recorded separately for passenger-train service. With this exception, the qualifications noted for many parts of the grain study apply to the estimates of the cost of passenger-train service.

Because of these qualifications, it is recommended that the Commission accept the cost presentations of the railways as a basis for a maximum subsidy, and that the actual subsidy be limited to the sum which the railways show to be their loss on this service, through the annual presentation of revised estimates.

Chapter 9

The Need for Future Analysis

This report has attempted to describe railway costing, as it exists in Canada today, using the cost of transporting grain to export positions as an extended example. Scattered throughout the report are references to areas of costing on which better evidence is needed. The point of view of the author, given at the conclusion of Chapter 3, is that the cost estimates given here provide a basis for decision, a better basis than has been available before. The Commission is faced with problems which demand decision. Insofar as cost is an element in those decisions, the cost estimates discussed here are, in the author's opinion, the best available at the moment.

To hold this point of view is not to suggest that there is no need for improvement. Improved cost estimates are needed by the railway managements in order that they may decide, with greater confidence, the limitations which their cost structure places upon their ability to compete with other modes of transport. They are needed in order to give better managerial control. It was pointed out in Chapter 3 that the precision with which management can attribute historical costs is one measure of its ability to control effectively the organization it controls. Imprecision in estimates of historical costs, whether caused by vagueness in knowledge or by the necessity to resort to arbitrary methods of apportionment of costs, is a measure of managements' lack of knowledge of the determinants of cost. Obviously, to the degree that the relation of costs to outputs is not known, the control of costs becomes impossible.

Improved knowledge of costs is important to the body which regulates the railroads or at least it will be so long as regulators insist that the railways cannot move traffic at non-compensatory rates. To those bodies which are responsible for determining the amount of investment which will be made in competing modes of transportation, a knowledge of the cost advantages and disadvantages of each mode of transportation will be a help in improving the quality of these decisions. As an example, it would be worthwhile to such an authority to know that if a projected highway transport operation is allowed, the new operation will be able to compete successfully with the railway for certain traffic and that the costs of transporting the traffic remaining with the railway will then rise sufficiently (on an average basis) that the total transportation bill will rise.

Because of the variety of situations which can arise, in which a knowledge of costs or of cost structures will be important to public authori-

ties, a small cost section could well be formed by the Dominion Government. This section could be given as its duties, the examination of cost estimates submitted to Dominion regulatory bodies and departments of government. Initially, the cost section might confine its activities to railways, building upon the basis which has been constructed during the Commission's hearings. Expansion to air transportation could be envisaged, and, with the co-operation of provincial authorities, to motor transport.

Initially, this cost section might begin its operations by consulting with the railways on the construction of cost estimates submitted in support of various applications by the railways. For example, should it be decided that the railways will be reimbursed for losses suffered in providing services which they are required by law to provide, the cost section should examine the estimates of loss suffered. When the railways wish to initiate changes in costing procedure, prior consultation with the cost section would do much to increase the public acceptance of improved costing techniques.

It would be unfortunate if such a cost section should leave the initiative for improvements in costing techniques entirely in the hands of the railways. As we have seen, some ways of attempting improvement are suggested by comparison of the results of using one railway's methods with another's data. A cost section in the Dominion Government may well be able to initiate such studies more successfully than could either of the railways. There are also cases, such as the method of attributing car days to particular traffic. Where basic differences in method such as this exist, an obvious function of the cost section would be to attempt to bring about agreement on the superiority of one method, and failing this, to recommend to the regulatory authority one method to be acceptable in official proceedings.

One of the purposes of the present report has been to provide a point of departure for such a body.

COST ESTIMATES

PRESENTED BY CANADIAN PACIFIC RAILWAY

Exhibit No. 63
(Revised)

CANADIAN PACIFIC RAILWAY

VARIABLE PORTION OF ROAD MAINTENANCE EXPENSE APPLICABLE TO THE STUDY TRAFFIC

	Account	*Group of Accounts*	*Independent Variable*	*Unadjusted Coefficient or Unit Cost*	*Adjust-ment Factor*	*Adjusted Coefficient or Unit Cost*	*Suptce*	*Total Coefficient or Unit Cost*	*Output Unit of Study Traffic*	*Applicable to Study Traffic*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1	201	Road Maintenance Superin-	Road Mtce Expenses	$0.03288	1.59587	$0.05247	—	—	—	—	1
2	274	tendence and Overhead	Excluding Suptce								2
3	276										3
4	277										4
5	202	Track Maintenance and De-	Thousands of Gross	$0.16475	1.01430	$0.16711	$0.00864	$0.17575	12,233,795	$2,150,089	5
6	208	preciation	Ton-Miles-Frt.								6
7	212										7
8	214		Yd and Train Swg.	$0.39053	1.01430	$0.39611	$0.02049	$0.41660	1,046,493	435,969	8
9	216		Miles								9
10	218										10
11	229										11
12	266										12
13	269										13
14	271										14
15	273										15
16	281										16
17	227	Station and Office Bldgs	Carloads	$1.33237	1.06861	$1.42378	$0.06991	$1.49369	175,203	261,699	17
18	266	Maintenance and Depreciation									18
19	231	Water and Fuel Stations	$ of Fuel Expense[1]	$0.01070	1.00285	$0.01073	$0.00056	$0.01129	2,662,837	30,063	19
20	266	Maintenance and Depreciation	$ of Water Expense[1]	$0.45140	1.00285	$0.45269	$0.02368	$0.47637	72,565	34,568	20

21	235	Shops and Enginehouses	$ of Direct Equip. Mtce	$0.05230	1.31299	$0.06867	$0.00274	$0.07141	7,072,797	505,068	21
22	266	Maintenance and Depreciation									22
23	249	Signals Maintenance and De-	Train-Miles	$0.04772	1.06483	$0.05081	$0.00250	$0.05331	3,490,182	186,062	23
24	266	preciation									24
25	253	Power Plants Maintenance and	$ of Station Employees	$0.01546	1.23230	$0.01905	$0.00081	$0.01986	885,043	17,577	25
26	266	Depreciation									26
27	275	Insurance and Joint Facilities	$ of Road Maintenance	$0.01060	1.00000	$0.01060	$0.00056	$0.01116	3,621,095	40,411	27
28	278										28
29	279										29
30										$3,661,506	30

[1]Account 231 was analysed by regression which showed that this account varied with water and fuel expense. The expense was in turn charged to output units of the study traffic on the basis of fuel and water expense of the study traffic.

405 (Revised)

Exhibit No. 64
(Revised)

CANADIAN PACIFIC RAILWAY

VARIABLE PORTION OF EQUIPMENT MAINTENANCE EXPENSE APPLICABLE TO THE STUDY TRAFFIC

	Account	*Group of Accounts*	*Independent Variable*	*Unadjusted Coefficient or Unit Cost*	*Adjustment Factor*	*Adjusted Coefficient or Unit Cost*	*Output Unit of Study Traffic*	*Applicable to Study Traffic*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1	301	Equipment Mtce Suptce and Over-	$ of Direct Equip. Mtce	$0.04990	$2.00526	$0.10006	$7,072,797	$707,704	1
2	302	head	Excl. Depreciation						2
3	305								3
4	306								4
5	329								5
6	332								6
7	333								7
8	334								8
9	335								9
10	336								10
11	337								11
12	308-311	Road Locomotive Repairs	Train Miles	$0.39718	—	$0.39718	4,465,450	1,773,587	12
13			Train Swg. Miles	$0.34653	—	$0.34653	244,029	84,563	13
14		Yard Locomotive Repairs	Yard Swg. Miles	$0.20762	—	$0.20762	802,464	166,608	14
15								2,024,758	15
16	331	Road Locomotive Depreciation	Train Miles	$0.16496	—	$0.16496	4,465,450	736,621	16
17			Train Swg. Miles	$0.26799	—	$0.26799	244,029	65,397	17
18		Yard Locomotive Depreciation	Yard Loco-Miles	$0.14384	—	$0.14384	802,464	115,426	18
19	314	Freight Train Car Repairs	Car-Miles	$0.01712	—	$0.01712	213,831,793	3,660,800	19
20			Car Days	$0.25363	—	$0.25363	5,274,358	1,337,735	20
21								4,998,535	21

22	331	Freight Train Car Depreciation	Car-Miles	$0.00427	—	$0.00427	213,831,793	913,062	22
23			Car Days	$0.22957	—	$0.22957	5,274,358	1,210,834	23
24								2,123,896	24
25	326	Work Equipment Repairs	$ of Road Mtce	$0.01352	—	$0.01352	$3,661,506	49,504	25
26	331	Work Equipment Depreciation	$ of Road Mtce	$0.00437	—	$0.00437	$3,661,506	16,001	26
									27
27								$10,837,842	28
28									

406 (Revised)

Exhibit No. 65
(Revised)

CANADIAN PACIFIC RAILWAY

VARIABLE PORTION OF TRANSPORTATION EXPENSES APPLICABLE TO THE STUDY TRAFFIC

	Account	*Group of Accounts*	*Independent Variable*	*Unadjusted Coefficient or Unit Cost*	*Adjust-ment Factor*	*Adjusted Coefficient or Unit Cost*	*Suptce*	*Total Coefficient or Unit Cost*	*Output Units of Study Traffic*	*Applicable to Study Traffic*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
1	371	Transportation Superintendence	$ of Transportation Exp.	$0.02442	1.79756	$0.04390	—	—			1
2	374	and Overhead									2
3	410										3
4	411										4
5	415										5
6	416										6
7	420										7
8	372	Dispatching and Station	Carload	$5.61490	1.01101	$5.67672	$0.24649	$5.92321	175,203	$1,037,764	8
9	373	Employees and Expenses									9
10	376										10
11	377	Yardmasters and Clerks	Yard Switching Mile	$0.46992	1.09439	$0.51428	$0.02063	$0.53491	802,464	429,246	11
12	378	Yard Expenses		$2.37435	1.00498	$2.38617	$0.10423	$2.49040	802,464	1,998,456	12
13	379										13
14	380										14
15	382										15
16	385										16
17	389										17
18	386, 388	Yard Other Expenses	Yard Switching Mile	$0.14389	1.01193	$0.14561	$0.00632	$0.15193	802,464	121,918	18
19	392	Train Enginemen, Train Loco.-	Direct	—					—	6,378,621	19
20	394	Fuel and Power, Trainmen									20
21	401	Train Switching	Direct	—					—	279,950	21

22	398	Train Enginehouse Expenses and	Loco.-Miles	$0.14400[1]	1.02378	$0.14742	$0.00632	$0.15374	4,709,724	724,073	22
23	400	Train Loco. Other Supplies									23
24	397	Train Locomotive Water	Direct per Loco.-Miles	$0.01331	0.99913	$0.01330	$0.00058	$0.01388	4,709,724	65,371	24
25	402	Train Other Expenses	Car-Miles	$0.00222	0.94909	$0.00211	$0.00010	$0.00221	213,831,793	472,568	25
26			Grain Doors (Direct)							716,395	26
27			Train Miles	$0.17772	0.94909	$0.16867	$0.00780	$0.17647	4,465,450	788,018	27
28	404	Signals Operation	Train Miles	$0.01146	1.06483	$0.01220	$0.00050	$0.01270	3,490,182	44,325	28
29	390-391	Joint Facilities and Insurance	$ of Transportation	$0.01206	1.00000	$0.01206	$0.00053	$0.01259	13,371,910	168,352	29
30	412, 413, 414										30
31	418	Loss and Damage—Freight	Direct						—	315,205	31
32										$13,540,262	32

[1]Regression analysis indicated separate coefficients for steam and diesel locomotive-miles. A weighted coefficient was developed from that analysis based on the weighted locomotive-miles of steam and diesel on the Prairie and Pacific Region in 1958.

407 (Revised)

Exhibit No. 66
(Revised)

CANADIAN PACIFIC RAILWAY

COST OF MONEY FOR INVESTMENT IN ROAD PROPERTY AND EQUIPMENT APPLICABLE TO STUDY TRAFFIC

	Name of Investment Category	*Independent Variable or Output Unit*	*Unit Variable Cost*	*Output Units of Study Traffic*	*Applicable to Study Traffic*		
	(1)	(2)	(3)	(4)	(5)	(6)	
1	Road Property	Gross Ton-Miles	$0.28926	12,233,795	$ 3,538,748		1
2		Yard and Train					2
3		Switching Miles	$0.84033	1,046,493	879,399	$ 4,418,147	3
4	Diesel Yard Locos	Yard Engine Miles	$0.25778	802,464	206,859		4
5	Diesel Road Locos	Train-Miles	$0.30748	4,465,450	1,373,037		5
6		Train Swg. Miles	$0.23700	244,029	57,835		6
7	Steam Locos	Train-Miles	$0.04291	4,465,450	191,612		7
8		Yard Swg. Miles	$0.06055	802,464	48,589		8
9		Train Swg. Miles	$0.18979	244,029	46,314		9
10	Freight Train Cars	Car Days	$0.99994	5,274,358	5,274,042		10
11	Work Equipment	Gross Ton-Miles	$0.00786	12,233,795	96,158		11
12	Shop and Power Plant Mach'y	Train-Miles	$0.02974	4,465,450	132,802	$ 7,427,248	12
13						$11,845,395	13

408 (Revised)

Exhibit No. 67
(Revised)

CANADIAN PACIFIC RAILWAY

DEVELOPMENT OF COST FOR LINES SOLELY RELATED TO THE STUDY TRAFFIC

	Account Number	Group of Accounts	Coefficient (per Mile of Track)	Adjustment Factor	Adjusted Coefficient per Mile of Track	
	(1)	(2)	(3)	(4)	(5)	
	A. *Road Maintenance and Depreciation*					
1	201, etc.	Road Maintenance Superintendence and	$ 43.92223	1.64255	$ 72.14446	1
2		Overhead				2
3	202, etc.	Track Maintenance and Depreciation	1136.81110	1.04397	1186.79668	3
4	221-266	Fences, Snowsheds and Signs, Maintenance				4
5		and Depreciation	$ 58.83700	.98748	58.10036	5
6					$1317.04150	6
7		*ADD* Superintendence (at $0.05247 per $ of direct Road Maintenance)			62.73566	7
8				Total Road Maintenance per Mile of Track	$1379.77716	8
	B. *Investment in Road Property*					
9	Gross Property Investment Associated with					9
10	Miles of Track (Statement 404)	$15,130.387				10
11	*Less* Accrued Depreciation @ 36.07%	5,457.531				11
12	Net Investment	$ 9,672.856				12
13	Investment Cost				$1004.04245	13
14				Total	$2383.81961	14
15	Miles of Track Solely Related to Study Traffic			3114.9		15
16	Total Cost for Lines Solely Related to Study Traffic					16
17	Road Maintenance Portion			$4,297,868		17
18	Road Property Investment Portion			3,127,492		18
19			Total	$7,425,360		19
20	*Less* Credit Net Contribution Non-Grain Traffic					20
21	Road Maintenance Portion		$677,207			21
22	Road Property Investment Portion		492,793	$1,170,000		22
23					$6,255,360	23

409 (Revised)

Exhibit No. 68

(Revised)

CANADIAN PACIFIC RAILWAY

VARIABLE COST OF TRAFFIC AND GENERAL, COMMUNICATIONS—RAIL, RENTS AND TAXES (OTHER THAN INCOME TAXES) APPLICABLE TO THE STUDY TRAFFIC

A. *Percentage Relationship that Traffic and General, Communications—Rail, Rents and Taxes (other than Income Taxes) is to Total Freight Operating Expense—Year 1958*

Traffic and General	12.423%
Communications—Rail	1.965
Rents and Taxes	2.819
Total	17.207%

B. *Base Relationship Variable Cost Study Traffic*

Roadway Maintenance—Variable	$ 3,661,506
Roadway Maintenance—Solely Related Facilities	4,297,868
Equipment Maintenance	10,837,842
Transportation	13,540,262
	$32,337,478

C. *Applicable to Study Traffic*

Traffic and General	12.423%	$4,017,285
Communications—Rail	1.965	635,431
Rents and Taxes	2.819	911,594
Total	17.207%	$5,564,310

410 (Revised)

Exhibit No. 69
(*Revised*)

CANADIAN PACIFIC RAILWAY

DEVELOPMENT OF CONSTANT COSTS

A. *System Railway Expenses*		
System Railway Expenses—1958	$430,919,006	
Deduct:		
Total Freight Variable Expenses (including Traffic General and Taxes)	$230,807,578	
Passenger Variable Expenses (including Traffic General and Taxes)	86,303,682	
Income Tax	19,200,000	
Accts. 237, 241 and 265 (including Overhead and Traffic General Taxes)	635,980	
Size Related Costs—Constant	37,887,169	374,834,409
Balance		$ 56,084,597
Percentage Chargeable Study Traffic		15.013%
Amount Applicable Study Traffic (excluding Cost of Money)		8,419,981
B. *Cost of Money*		
Total Road Property Investment—1958		$1,265,184,445
Deduct:		
Commercial Communications	$ 57,303,370	
Wharves	16,400,206	
Grain Elevators	3,033,101	
Other Structures	5,980,070	
Size Related Investment	354,470,168	
Variable Investment	461,216,114	898,403,029
Balance (Gross Investment)		$366,781,416
Net Investment @ 63.93%		234,483,359
Cost of Money @ 10.38%		24,339,373
Plus Work Equipment	$ 167,756	
Shop and Power Plant machinery	203,868	371,624
		$ 24,710,997
Percentage Chargeable Study Traffic		15.013%
Amount Applicable Study Traffic		3,709,862
C. *Total Constant Costs* Applicable to Study Traffic		$ 12,129,843

411 (Revised)

Exhibit No. 70
(Revised)

CANADIAN PACIFIC RAILWAY

DEVELOPMENT OF CONSTANT COST PORTION OF SIZE RELATED COSTS

	Account Number	*Group of Accounts*	*Cost per Mile of Track*	*Adjustment Factor to reflect System Exps.*	*Adjusted Cost per Mile of Track*	
	(1)	(2)	(3)	(4)	(5)	
1	201, etc.	Road Maintenance, Superintendence and Overhead	$ 43.92223	1.64255	$ 72.14446	1
2	202, etc.	Track Maintenance and Depreciation	1136.81110	1.04397	1186.79668	2
3	221–266	Fences, Snowsheds and Signs Maintenance and Depreciation	58.83700	.98748	58.10036	3
4		*Add* Superintendence (at $0.05247 per $ of Direct Road Maintenance)			62.73566	4
5					$ 1379.77716	5
6		Traffic, General, Joint Facility Rents, Communications—Rail and Taxes @ 17.207%			237.41826	6
7					$ 1617.19542	7
8		Investment Cost in Road Property (Statement 409)			1004.04245	8
9					$ 2621.23787	9
10		Miles of Track Maintained System after deducting miles of track of solely related facilities			20,312.8	10
11		Total Costs Associated with size of plant			$ 53,244,681	11
		Applicable to Study Traffic Percent that variable expense applicable to study traffic after deducting costs of solely related facilities bears to total variable expenses freight services				
12		Percent			15.013%	12
13		Amount			$ 7,993,624	13

412 (Revised)

Appendix B

COST ESTIMATES

PRESENTED BY CANADIAN NATIONAL RAILWAYS

Exhibit 57 ZZ

(Revised)

CANADIAN NATIONAL RAILWAYS

VARIABLE COST OF MOVING GRAIN AND GRAIN PRODUCTS AT STATUTORY AND RELATED RATES

Road Maintenance	*Units variable with study traffic*	*Unit variable cost*	*Variable costs less depreciation*	*Depre-ciation ratio*	*Depreciation*	*Total variable costs*
	$	$	$		$	$
Superintendence and miscellaneous						
201, 274, 275, 276, 277						
Direct road maintenance expense	5,086,003	0.11554				587,637
Track and road maintenance						
202, 208, 212, 214, 216, 218,						
229, 269, 270, 271, 273, 281						
Miles of roadway	2,955.3	893.37	2,640,176	.41548	1,096,940	3,737,116
Gross ton-miles freight trains (000)	10,491,665	.15041	1,578,051	.41548	655,649	2,233,700
Yard locomotive-miles	556,290	.78064	434,262	.41548	180,427	614,689
Fences, snowsheds and signs—221						
Miles of fence	5330.8	41,167	219,458	.40473	88,821	308,279
Water and fuel stations—231						
Total diesel locomotive-miles	5,383,268	.0067222	36,187	.76379	27,639	63,826
Shops and enginehouses—235						
Direct equipment maintenance and enginehouse expenses	4,295,307	.04141	177,869	.27881	49,592	277,461
TOTAL ROAD MAINTENANCE VARIABLE COST						7,772,708

NR 3-9 Revised

CANADIAN NATIONAL RAILWAYS

VARIABLE COST OF MOVING GRAIN AND GRAIN PRODUCTS AT STATUTORY AND RELATED RATES

Equipment Maintenance	*Units variable with study traffic*	*Unit variable cost*	*Variable costs less depreciation*	*Depre-ciation ratio*	*Depreciation*	*Total variable costs*
	$	$	$		$	$
Superintendence and miscellaneous						
301, 306, 329, 332, 333, 334, 335						
Direct equipment maintenance expenses	6,135,124	.068629				421,047
Shop and power plant machinery—302						
Locomotive, freight cars and work equipment expenses	5,878,650	.043628	256,474	.19466	49,925	306,399
Diesel locomotives—311 A						
Road unit miles	7,933,928	.31794	2,522,513		876,494	3,399,007
Yard unit miles	556,290	.23676	131,707		76,584	208,291
Freight train cars—314						
Car days	3,547,084	.22842	810,225			
Car-miles	192,188,135	.011255	2,163,077			
Total			2,973,302		1,264,607	4,237,909
Work equipment—326						
Related road maintenance accounts	5,240,126	.047924	251,128	.26469	66,471	317,599
201, 202, 208, 212, 214, 216, 218, 229, 269, 270, 271, 272, 273, 274, 275, 276, 277, 281						
TOTAL EQUIPMENT MAINTENANCE VARIABLE COST						8,890,252

NR 3-9 Revised

CANADIAN NATIONAL RAILWAYS

VARIABLE COST OF MOVING GRAIN AND GRAIN PRODUCTS AT STATUTORY AND RELATED RATES

Transportation	*Units variable with study traffic*	*Unit variable cost*	*Variable costs less depreciation*	*Depre-ciation ratio*	*Depreciation*	*Total variable costs*
		$	$		$	$
Superintendence and miscellaneous—371, 374, 410, 411, 414, 415, 416, 420						
Total train-miles	4,805,923	.13927				669,321
Yard locomotive-miles	556,290	.45875				255,198
Train control—249, 372, 404						
Total train-miles	4,805,923	.084036	403,871	.13546	54,708	458,579
Total carloads	141,134	.94938	133,990	.13546	18,150	152,140
Station employees and expenses—373, 376						
Carloads C.L.	141,134	4.3612				615,514
Yardmasters and yard clerks—377						
Yard locomotive-miles	556,290	.55244				307,317
Yard trainmen and enginemen—378, 380						1,029,989
Yard switchmen—379						19,504
Yard locomotive fuel and power—382						
Yard locomotive-miles	556,290	.1111				61,804

NR 3-9 Revised

CANADIAN NATIONAL RAILWAYS

VARIABLE COST OF MOVING GRAIN AND GRAIN PRODUCTS AT STATUTORY AND RELATED RATES

Transportation (continued)	*Units variable with study traffic*	*Unit variable cost*	*Variable costs less depreciation*	*Depre-ciation ratio*	*Depreciation*	*Total variable costs*
		$	$		$	$
Yard locomotive other supplies and enginehouse expenses—386, 388						
Yard locomotive-miles	556,290	.13996				77,858
Yard other expenses—389						
Yard locomotive-miles	556,290	.017906				9,961
Train enginemen and trainmen—392, 401						4,447,502
Train locomotive fuel and power—394						
Gallons of diesel fuel	12,142,947	.135				1,639,298
Train locomotive supplies and enginehouse expenses—398, 400						
Train locomotive-miles	4,826,978	.051696				249,535
Train other expenses—402						
Grain doors						847,846
Car lubrication—car-miles (000)	195,754	2.3456				459,161
Train supplies—train-miles	4,805,923	.18002				865,162
Loss and damage—freight						131,610
TOTAL TRANSPORTATION VARIABLE COST						12,297,299

NR 3-9 Revised

CANADIAN NATIONAL RAILWAYS

VARIABLE COST OF MOVING GRAIN AND GRAIN PRODUCTS AT STATUTORY AND RELATED RATES

Traffic, General and Other Expenses	*Units variable with study traffic*	*Unit variable cost*	*Variable costs less depreciation*	*Depreciation ratio*	*Depreciation*	*Total variable costs*
	$	$	$		$	$
Communications—Rail—247, 407						
Road maintenance, equipment maintenance and transportation expenses except depreciation and communications	24,454,252	.013642	333,605	.16391	54,681	388,286
Traffic expenses—351, 352, 353, 354, 355, 356, 357, 358, 359						
All expenses except traffic expense and depreciation	25,594,358	.026018				665,914
General expenses—451, 452, 453, 454, 455, 458, 460						
Road maintenance, equipment maintenance and transportation expenses except depreciation and communications	24,454,252	.032980				806,501
Pensions—457						
Labor expenses variable with study traffic	16,964,134	.06				1,017,848
Taxes—468						
Unemployment insurance—all expenses except pensions and depreciation	26,260,272	.004719				123,922
Property tax						262,883
Joint facilities and operation						35,155
Cost of money						
Net investment variable with study traffic	122,447,367	.1096				13,420,231
TOTAL TRAFFIC, GENERAL AND OTHER EXPENSES VARIABLE COST						16,720,740
TOTAL VARIABLE COST						45,680,999

NR 3-9 Revised

Exhibit 57 AAA

(*Revised*)

CANADIAN NATIONAL RAILWAYS

CROWSNEST GRAIN TRAFFIC STUDY

CONSTANT COSTS AND COSTS VARIABLE WITH TOTAL FREIGHT TRAFFIC, YEAR 1958

	Costs Variable With Freight Traffic	*Constant Costs*
	$	$
Road maintenance	39,000,000	77,900,000
Equipment maintenance	89,200,000	11,900,000
Traffic	3,900,000	3,700,000
Transportation	154,500,000	26,500,000
General	17,900,000	28,800,000
Communications—rail	3,300,000	2,500,000
Miscellaneous, rentals, taxes, and cost of money	113,200,000	160,400,000
	$421,000,000	311,700,000

NR 3-10 Revised

Exhibit 57 BBB

(Revised)

CANADIAN NATIONAL RAILWAYS

SHARE OF CONSTANT COSTS APPORTIONED TO GRAIN AND GRAIN PRODUCTS MOVING AT STATUTORY AND RELATED RATES

Cost variable with total freight traffic........................		$421,000,000
Variable cost of study traffic..	$ 45,700,000	
Less Solely related size variable costs.................................	$ 9,000,000	
Cost variable with study traffic output........................		$ 36,700,000
$\dfrac{\text{Costs variable with study traffic}}{\text{Costs variable with total freight traffic}} =$		$\dfrac{36,700,000}{421,000,000} = 8.72\%$
Study traffic's share of total constant costs $311,700,000 × 8.72%		$ 27,200,000
Less Solely related size variable costs.................................		$ 9,000,000
Study traffic's net share of constant costs..................		$ 18,200,000

NR 3-11 Revised

Exhibit 57 XX

(Revised)

CANADIAN NATIONAL RAILWAYS

Crowsnest Grain Traffic Study

ANNUAL DEPRECIATION OF ROLLING STOCK VARIABLE WITH GRAIN AND GRAIN PRODUCTS MOVING AT STATUTORY AND RELATED RATES

Box cars		
Number of cars	9,976	
Average cost	$ 4,448	
Gross investment	$44,372,192	
Annual depreciation @	2.85%	$1,264,607
Locomotives		
Road		
Number of units	91	
Average cost	$ 192,636	
Gross investment	$17,529,876	
Annual depreciation @	5.0%	$ 876,494
Yard		
Number of units	16	
Average cost	$ 119,663	
Gross investment	$ 1,914,608	
Annual depreciation @	4.0%	$ 76,584
Work equipment		
Gross investment	$ 1,899,171	
Annual depreciation @	3.5%	$ 66,471
Total annual depreciation variable with study traffic		$2,284,156

NR 3-7 Revised

Exhibit 57 YY

(Revised)

CANADIAN NATIONAL RAILWAYS

CROWSNEST GRAIN TRAFFIC STUDY

INVESTMENT VARIABLE WITH GRAIN AND GRAIN PRODUCTS MOVING AT STATUTORY AND RELATED RATES

FREIGHT CARS		
Gross investment	$ 44,372,192	
Less depreciation	10,793,092	
Net investment		$ 33,579,100
DIESEL LOCOMOTIVES		
Gross investment	$ 19,444,484	
Less depreciation	2,160,282	
Net investment		$ 17,284,202
ROAD PROPERTY		
Gross unit investment		
$ 4.35896 × 10,491,665 Gross ton-miles (000)	$ 45,732,748	
$12.6634 × 701,113 Switching miles	8,878,474	
$15,130.39 × 3439.9 Miles of track	52,047,029	
Gross investment	$106,658,251	
Less depreciation	38,471,631	
Net investment		$ 68,186,620
WORK EQUIPMENT		
Gross investment	$ 1,899,171	
Less depreciation	362,172	
Net investment		$ 1,536,999
SHOP AND POWER PLANT MACHINERY		
Gross investment	$ 1,973,320	
Less depreciation	112,874	
Net investment		$ 1,860,446
TOTAL NET INVESTMENT VARIABLE WITH STUDY TRAFFIC		$122,447,367

NR 3-8 Revised

INDICES OF GRADIENT AND CURVATURE PRESENTED BY W. B. SAUNDERS & CO.

DIVISION INDEXES OF GRADE AND CURVATURE

Division	*Total Weighted by Mileage*	*Total Weighted by Freight NTM*	*Weighted by Mileage Subtotal for:*	
			Main Subs.	*Branch Subs.*
DAR	301	295	......	301
Brownville	357	316	313	508
Woodstock	468	359	330	512
QCR	371	356	......	371
Farnham	325	279	315	344
Montreal Terminals	100	100	100	......
Laurentian	345	225	253	518
Smith's Falls	283	194	220	390
Trenton	291	195	244	401
Toronto Terminals	100	100	100	......
London	261	217	210	314
Bruce	309	212	194	357
Sudbury	292	239	252	412
Schreiber	295	296	294	300
Ft. William Terminals	100	100	100	......
Kenora	186	185	185	192
Winnipeg Terminals	100	100	100	100
Portage	193	185	181	196
Brandon	236	226	251	224
Regina	195	185	182	201
Moose Jaw	227	178	172	233
Saskatoon	196	174	171	212
Medicine Hat	211	192	199	217
Lethbridge	251	249	260	247
Calgary	285	276	284	288
Edmonton	220	162	221	220
Revelstoke	292	366	367	212
Vancouver	239	234	237	271
Kootenay	428	312	352	654
Kettle Valley	361	333	389	283
E and N	421	308	......	421

NOTE: Indexes are reciprocals of tonnage ratings for standard diesel units, related to the tonnage rating over straight, level track at 100.

53744-9—24

Appendix D

A NOTE ON THE RELATIONSHIP BETWEEN VARIATIONS IN PROFIT AND VARIABLE COST

It was argued, before the Commission, that the revenues received from the grain trade must, in reality cover variable costs because, "in years when there was a large grain crop, the Canadian Pacific Railway net revenues reflected a definite upward trend and . . . in years when there was a poorer grain crop there was a noticeable decline in the Canadian Pacific Railway's net revenues".[1]

The basis of this argument was that, for the years 1947 to 1958, the average yearly net revenues of the Canadian Pacific were $80,021,000 for the four years in which more than 300,000 cars of grain were loaded in Western Canada, while the net revenues of the railway averaged only $60,060,810 for the eight years in which less than 300,000 cars of grain were loaded in Western Canada. So that, "in other words, on the average, when western grain car loadings were over 300,000 cars a year the average 'net' was 33.23 per cent better than when such loadings were under 300,000 cars".

This argument neglects the possibility that net revenues were higher in years of greater car-loadings of grain because the Canadian economy was more active in those same years. It is possible that the greater net revenues of the Canadian Pacific were obtained from other types of traffic than shipments of western grain. It may be possible that the upsurge in the remainder of the economy was related to increased activity in the grain trade. However, as long as the possibility remains that the increased net revenues obtained by the railway were generated by other sectors of the economy independently of the grain trade, the contentions quoted in the paragraph above cannot be accepted without question.

A second and more important question can be raised to the argument of the first paragraph. The estimates of variable cost, presented by the Canadian Pacific, support the view that the net revenues of that railway will be higher in years of larger shipments of grain. That railway presented, as its revenues from shipments of western grain, some $35 million for the year 1958. Its estimate for the cost of transporting these shipments was some $33 million after deduction of its apportionment of fixed costs, the cost of maintaining "solely-related" lines, and the allowance for what may, variously, be termed cost of money, interest or normal profit. Of the three items deducted,

[1] The extended argument can be found in the transcript of Summations and Arguments, Vol. 1, p. 249-52.

only a portion of the normal profit can be expected to vary with traffic volume in a given year. Included in the variable costs were items of depreciation which are charged on a straight-line basis. These, too, will not vary with traffic volume in a given year to any appreciable extent. However, if one recalls the discussion of Chapter 2, it is possible to conceive of these costs being variable with a sufficient change in traffic volume, and given sufficient time to make the necessary adjustments.

If a segment of traffic returns revenues sufficient to cover those costs which vary in a given year, that segment will appear to add to the profits of the railway in good years. This effect can occur because the increased revenues, which accrue in years when the specific traffic is heavy, are sufficient to reduce the loss which is incurred on expenditures which cannot be varied in the course of a single year; even though these expenditures would be eliminated over a period of two or more years, if the particular traffic were removed from the railway.[1]

An example of this type of expenditure, which will vary over a period of years but is unlikely to change significantly in a single year, is the expenditure required for the ownership of box cars. R. L. Banks and Associates argued that the reaction of the Canadian Pacific to increased traffic is to increase the utilization of box cars, and that, similarly, Canadian Pacific decreases the utilization of box cars in response to decreases in traffic volume. This contention was supported by the presentation of two graphs which are reproduced at the end of this Appendix. Banks argued that the closeness, with which the points of his Figure I, "Intensity of Use Compared with Traffic Volume", fitted the trend line, suggested that from 1924 through 1958 the reaction of Canadian Pacific to changed traffic volume, as measured by loaded freight car-miles, was to change the utilization of cars, as measured by car-miles per car owned. On the other hand, he argued that the poorness, with which the points of his Figure II, "Calendar Car-Days Compared with Traffic Volume", fitted the trend line, indicated that there was no significant adjustment of freight car fleet to changes in traffic volume.

An examination of Banks' Figure II shows that there was a considerable reduction in the number of available car-days between the years 1929 and 1940 inclusive. During this period, traffic declined from 1929 to 1933 and then increased until 1940. Between 1929 and 1933, the decrease in traffic, as measured by loaded freight car-miles, was approximately one-third. Figure II suggests that the adjustment, required to complete the changes in numbers of cars owned in response to this loss of traffic, was not completed until 1940. In 1941 the railway was able to carry a sharply increased amount of traffic with few more cars available. Following that

[1] Cf. the discussion in Chapter 2, p. 202-205.

period the general trend in car ownership seems to have approximated the trend in traffic. Thus, in the two periods, 1927 to 1933 and 1941 to 1958, the general trends exhibited in Figure II are those which one would expect if car ownership is adjusted on the basis of traffic volume. The contrary trend exhibited for the years 1933 to 1940 can be explained by the long time necessary to adjust to the large decrease in traffic of the depression years. The contrary trend of the years 1924 to 1926 or '27 remains unexplained but the movement does not appear sufficiently large to bring the general pattern into serious question.

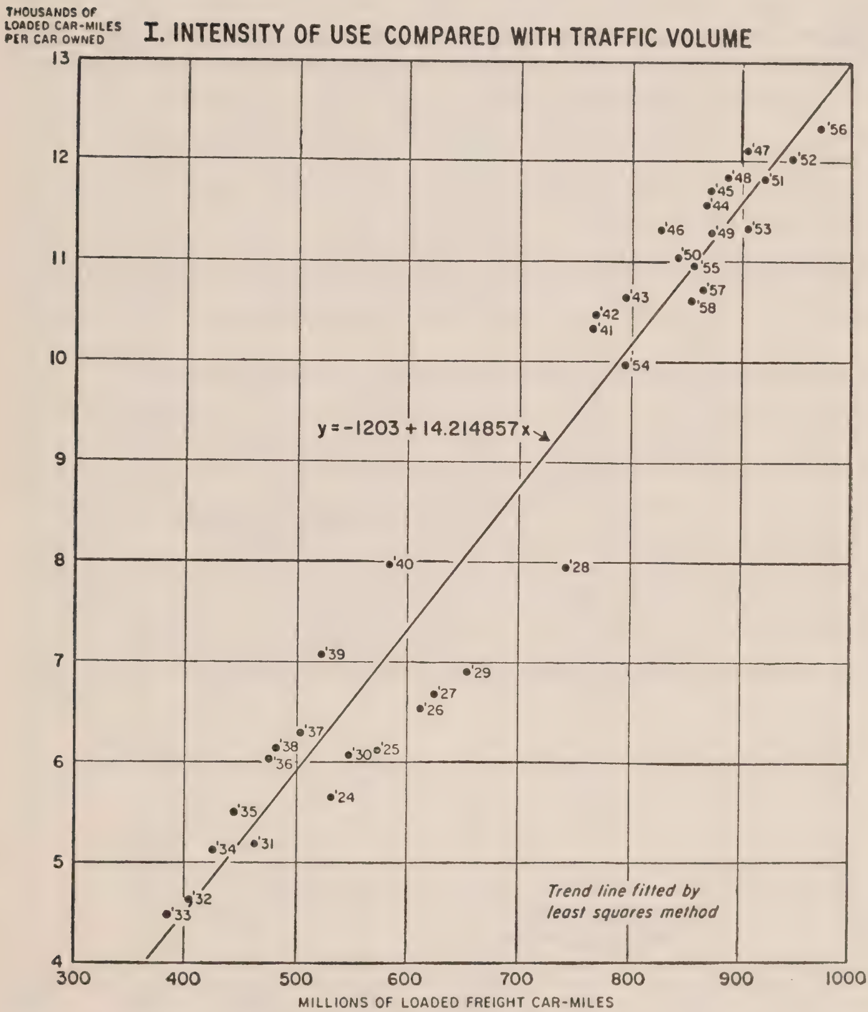
Reverting to Figure I, it will be seen that from 1924 to 1931 the points fall below the general trend line, from 1932 to 1950 they fall above the trend line, and that from 1951 to 1958 the points again fall below (with the exception of 1955 which appears to fall upon the line). If there is not at least one factor systematically affecting the relationship exhibited by Figure I, the points for consecutive years would be expected to fall above and below the trend line at random. The chances of the pattern shown by Figure I, arising by chance are similar to the chances, when tossing a coin, of obtaining eight consecutive heads followed by nineteen consecutive tails followed, in turn, by seven consecutive heads. (The year 1955 is omitted in this analogy.) The discussion of Figure II given above appears to shed some light upon this unusual result. It must be assumed, in the absence of further evidence, that the Banks' argument does not prove that the ownership of cars will not be varied in response to changes of traffic volume. However, it also seems clear that the immediate result of a change in traffic volume will be a change in the utilization of the car fleet. In these circumstances, an increase in traffic will yield increased revenues which may appear to yield a profit while, in fact, merely reducing the loss caused by the necessity to own sufficient cars to carry the peak traffic.

CHART I
Manitoba-Alberta
Memorandum No. 2
Exhibit No. ______

CANADIAN PACIFIC RAILWAY

(including subsidiary companies in Canada)

Freight Car Trends, 1924 through 1958



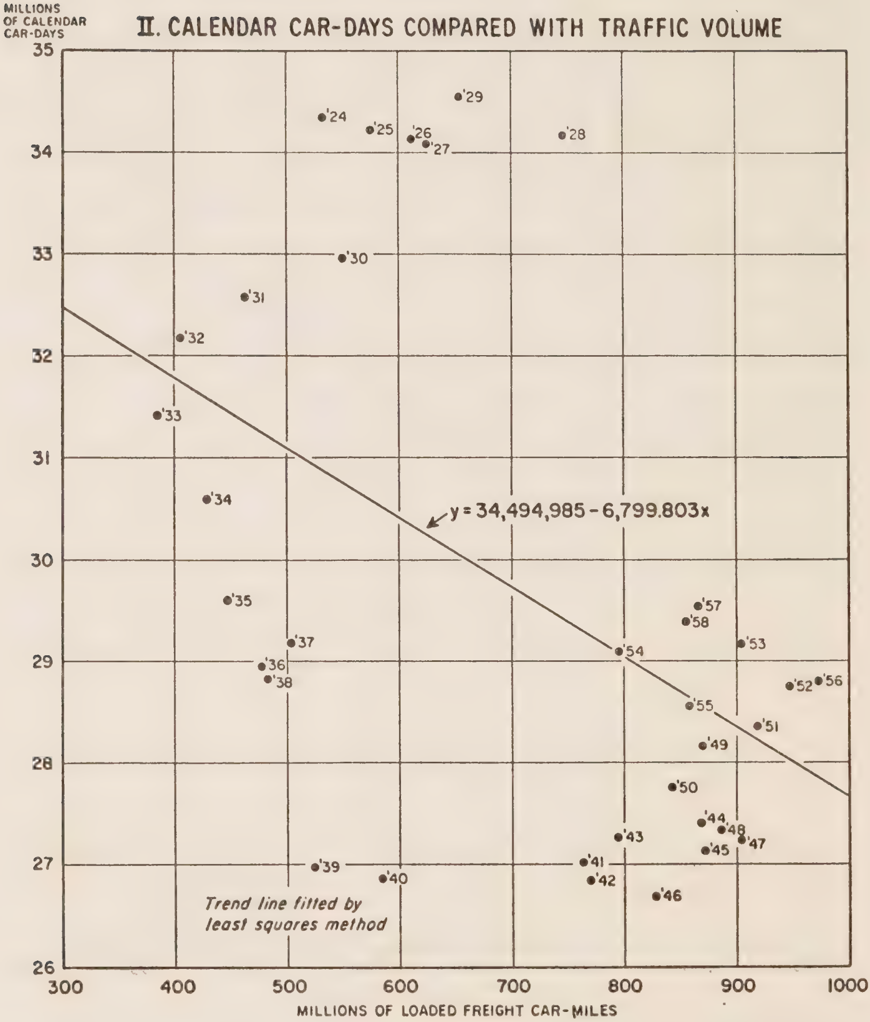
Source: Dominion Bureau of Statistics

CHART II
Manitoba-Alberta
Memorandum No. 2
Exhibit No. ______

CANADIAN PACIFIC RAILWAY

(including subsidiary companies in Canada)

Freight Car Trends, 1924 through 1958



Source: Dominion Bureau of Statistics

Appendix E

RELATION OF PRESENT ESTIMATES TO EARLIER RECOMMENDATIONS

Prior to the publication of Volume I of the Report of the Commission, preliminary estimates of the cost of moving grain to export positions were given to the Commission. In memoranda and discussions, amounts were suggested for the marginal cost, a reasonable range of contribution to fixed costs, and the cost of maintaining substantially-related lines. Of these amounts, only the estimate of variable cost has been significantly changed, in this report, from the earlier estimate presented to the Commission.

The preliminary estimate of the variable cost of transporting grain to export positions, including an allowance for interest or normal profit on the investment variable with the grain trade, was approximately $37.6 million for the Canadian Pacific Railway. In the present report, this amount has been estimated at approximately $34.8 million. The difference is due to modifications in the estimates of the variable cost, excluding the allowance for interest.

Since the Commission has recommended that the estimates of variable cost be recalculated each year, the numerical results of this report are chiefly, if not entirely, of historical interest. Therefore, it is suggested that the Commission make no change in the recommendations which it made in Volume I of its Report, insofar as those recommendations are concerned with remuneration for the transportation of grain to export positions. The fact that, in making its recommendations, the Commission foresaw the possibility that the revenues for the transportation of the grain traffic might exceed the variable cost in certain years, is a further reason that no revision of these recommendations need be made as a result of the changed estimates presented in this report.

Statutory Grain Rates

by
E. P. Reid

OTTAWA 1960

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Statutory Grain Rates

Scope and Purpose

The problem of statutory grain rates has come before the Commission as a logical element in its consideration of "(a) inequities in the freight rate structure . . .; (b) the obligations and limitations imposed upon the railways by law . . .; and (c) such other related matters as the Commissioners consider pertinent . . .".[1]

This research report is designed to provide an economic assessment of

1. the alleged burden to the railways in carrying statutory grain traffic;
2. the historical and present place of statutory rates in the Prairie farm economy, the Prairie economy, and the national economy; and
3. the probable impact on the Prairies and their farm economy of any changes in the statutory rates.

Historical Review and Analysis

National Policy and Transportation Policy

The statutory grain rates had their origin in an era when a most prominent element in Canada's national policy was the peopling of the West. The intention was that the land and settlers should be organized to farm and produce mainly grain for export and that the various economic activities that flowed from this should be a benefit to all the other people on the Prairies and the people and areas in other parts of Canada handling the western product or producing and shipping food and supplies to the West.

Clearly this national policy called for abundant and moderately-priced transportation. The Canadian Pacific Railway Company itself in its initial building stage, 1881 to 1886, illustrated this, and the Crowsnest Pass Agreement was a further development of national transportation policy at the core of national policy. In the case of both, the original charter and the

[1] Order in Council P.C. 1959-577, setting out the Terms of Reference of this Commission.

1897 arrangements, federal assistance was of a capital nature and the Company undertook to build its lines and give some degree of rate protection. The idea was that when the lines commenced operation the railway would try to build its business as much as it could to serve its purposes and in doing so would be serving also the public's purposes.

A national policy does not necessarily mean the loss of money by anybody, or the subsidization of anybody, or lack of reliance on free enterprise or competitive forces. The implementation of a subsidy may be justified as a means of either giving greater horizon to free enterprise by overcoming a capital shortage or surmounting an inherent geographic disadvantage.

Today's statutory grain rates, which are a practical extension of the Crowsnest Pass Agreement rates, are those applying on carload shipments of grain and grain products, including flour, from Prairie points: (1) to Fort William, Port Arthur and Armstrong, Ontario; (2) to Pacific Coast terminals (Vancouver, New Westminster, Victoria and Prince Rupert) *for export;* and (3) to Churchill *for export.*

The Crowsnest Pass Agreement

In the 1897 Crowsnest Pass Agreement the Canadian Pacific obtained a subsidy of $3,404,720 from the Government of Canada to build a line from Lethbridge through the Crowsnest Pass into the Kootenay area of British Columbia where coal and other mineral discoveries had been made. In exchange the railway undertook to reduce freight rates on:

1. a number of articles important to settlers and farmers, on their movement from Central Canada to the Prairies;[1] and
2. grain and flour from its lines on the Prairies to Fort William and Port Arthur by three cents per 100 pounds. This provided rates to Fort William, for example, as follows:

Winnipeg,	420 miles,	14 cents per 100 lbs.
Regina,	776 miles,	20 cents per 100 lbs.
Calgary,	1,242 miles,	26 cents per 100 lbs.

As part of the Agreement the railway undertook "that no higher rates than such reduced rates or tolls shall be hereafter charged by the Company between the points aforesaid".[2] These are the phrases which have (quite logically) been taken by the Prairie people as an undertaking in perpetuity.

[1] Green and fresh fruits, 33⅓ per cent reduction; coal oil, 20 per cent; and cordage and binder twine, agricultural implements, iron, wire, window glass, paper for building and roofing purposes, roofing felt, points, livestock, wooden ware and household furniture, 10 per cent.

[2] Statutes of Canada, 1897, 60-61 Victoria, Ch. 5, Sec. 1 (*d*) and 1 (*e*).

Fowke has summarized the objectives of the contracting parties as follows:[1]

Government of Canada

"(1) the more rapid development of the highly promising mining area of southern British Columbia,

(2) the effective integration of this area into the Canadian economy in defiance of geographic facts and despite American designs,

(3) the enlargement of the prairie and inter-mountain markets for eastern manufacturers through the provision of lower freight rates on the western movement of certain important products,

(4) the stimulation of agricultural settlement and general economic expansion in the prairie provinces by means of the statutory assurance of lower rates on grain and on the inward movement of capital equipment, and

(5) the acceptance by the Canadian Pacific Railway Company of the principle of governmental rate control in the national interest."

Canadian Pacific Railway Company

"(1) the subsidy, more substantial than that considered by the previous government, would pay, according to the Company's own recorded estimates, upwards of one-half of the cost of the Crow's Nest line,

(2) construction of this line would entitle the Company to a large land subsidy indirectly from the Province of British Columbia,

(3) the line would provide an all-rail link between the Company's main line and the Kootenay region, and

(4) it would thus be possible to forestall American economic occupation of that wealthy area and to secure for the Canadian Pacific Railway Company first claim upon the traffic benefits to be derived from economic development in the southern Canadian Cordillera."

History of Agreement Rates

The importance of the Agreement is not placed in doubt by recapitulating the history of grain rates from the Prairies to the Lakehead to show that, between the effective date of full reduction, September 1, 1899, and the 1925 statute, the rates were precisely in effect for only seven and a fraction of the twenty-six years.

[1] Evidence tendered by Dr. Vernon C. Fowke on behalf of the Respondents (Western and Maritime Provinces) on Jan. 12, 1953, before the Board of Transport Commissioners in Rate Base-Rate of Return case, Ottawa, Vol. 912, p. 780-781.

Another agreement between the Government of Manitoba and the Canadian Northern Railway, made for competitive purposes, brought effective rates 3 cents lower in Manitoba and 2 cents lower in Saskatchewan and Alberta between 1903 and 1918. After staying at Crowsnest levels for a few months in the latter year, special action in the face of post World War I inflation led to considerable temporary increases until July 1922, when Crowsnest levels were restored. Rates as much as 14.5 cents (Calgary) above Agreement rates had briefly prevailed in 1920.

When, in 1922, Agreement levels were restored on the eastbound movement of grain, the suspension of the Agreement rates on westbound movement of settlers' goods and farm equipment was not lifted, and in the 1925 compromise both these decisions were embodied in the Railway Act. The grain rates were, by action of the Board of Railway Commissioners in application of the legislation, applied on a uniform mileage basis to all lines in the grain area and to export shipments to Pacific Coast terminals.

Westbound Commodities in the Agreement

Not as much has been written about the cancelled westbound rates on materials as on Crowsnest grain rates. The history of the rate on agricultural implements since shortly after the Agreement has been tabulated. This is one of the most important categories in the list of commodities reduced for westbound movement in the Agreement.

It may be observed that the 1904 rate on farm implements was 98 cents per 100 pounds. This was presumably the rate called for in the Agreement and therefore replacing an 1897 rate of $1.09. Also in 1904 the otherwise applicable 6th class rate was $1.01, 3 cents higher. This was presumably not affected by the Agreement, but it must have been reduced from 1897 through other influences or it would have been the applicable rate for implements from which 10 per cent would on January 1, 1898, be removed. By 1908 the commodity rate had subsided to 87 cents and use of the class rate allowed an 86 cents rate for a time after 1914. Post-war increases were wiped out in 1924, when 97 cents briefly became the rate, in line with the Agreement (although a 1 cent discrepancy appears). The large increase to $1.28 in late 1924—in consequence of the Board of Transport Commissioners' order disallowing Crowsnest rates published for 1897, stations only on the ground of discrimination against other stations—was wiped out in January 1925, by an Order in Council of the previous month. There was an appeal to the Supreme Court, whose finding was for the Crowsnest Pass Agreement literally as 1897 conditions—stations and lines—indicated in 1925. The Railway Act amendment (Sec. 328: (6) and (7)) of that year followed, and westbound rates on implements and other agreement commodities were henceforth not bound but subject to regulation by the Board.

TABLE I—CARLOAD RATES ON AGRICULTURAL IMPLEMENTS
(in cents per 100 pounds)
(TORONTO TO REGINA)

Effective date	*Commodity rates*	*6th class rates*	
Aug. 1, 1904	98	101	
Apr. 4, 1905	98	101	
Dec. 23, 1907	97	97	
Mar. 10, 1908	87	97	
Apr. 1, 1912	87	89	
Aug. 1, 1912	—	89	
Sept. 1, 1914	—	86	
Sept. 1, 1917	—	87	
Apr. 1, 1918	97	98½	
Aug. 20, 1918	—	112½	
Sept. 1, 1919	102½	112½	
Sept. 23, 1920	140	154	
Jan. 1, 1921	138½	148½	
Dec. 1, 1921	128	137	
July 7, 1924	97	137	
Oct. 27, 1924	128	137	
Jan. 9, 1925	97	137	
July 23, 1925	128	137	
Apr. 8, 1948	155	166	
Dec. 27, 1948	—	166	
Jan. 11, 1949	155	166	
Oct. 11, 1949	167	179	
Mar. 23, 1950	180	193	
June 16, 1950	186	199	
July 24, 1950	—	199	
July 26, 1951	—	223	
Feb. 11, 1952	—	233	
		Normal	*Bridge*[a]
May 1, 1952		233	221
Jan. 1, 1953		254	242
Mar. 16, 1953		272	259
May 1, 1953		272	253
Mar. 1, 1955		262	243
Nov. 1, 1955		262	236
Mar. 1, 1956		262	243
July 3, 1956		280	261
Jan. 1, 1957		291	271
Mar. 1, 1957		291	273
Aug. 1, 1958		290	272
Dec. 1, 1958		339	320
Mar. 1, 1959		339	317
Aug. 1, 1959[b]		319	297
Dec. 1, 1959		319	289
May 6, 1960[b]		313	283

[a] Rate reflects "bridge" subsidy reduction under Section 468 of the Railway Act.

[b] Roll-back was to 110 per cent instead of 117 per cent Aug. 1, 1959, and to 108 per cent instead of 117 per cent May 6, 1960.

The rate of \$1.28, which had been effective from 1921 to 1924 and which was 32 per cent above the Agreement level, was established and this prevailed until the first post-war general increase of 21 per cent took place in 1948. This rate was 9 cents (7 per cent) less than the otherwise applicable 6th class rate. The commodity rate seems to have lapsed for two weeks at December 27, 1948. Upon being restored, the commodity rate took the subsequent 20 per cent increase in the regular three stages in 1949 to 1950, but final cancellation of the commodity rate came on July 24, 1950, causing an immediate 13 cents jump in the effective rate (the same 7 per cent as mentioned for 1948).

This 6th class became class 40 on March 1, 1955, with the changes in designations accompanying equalization, and the rate fell from \$2.72 (normal) to \$2.62 (normal).[1] Meanwhile, on May 1, 1952, the "bridge" subsidy had reduced the rate for the shipper but had no effect on carrier revenue. The same comment would apply to the roll-back of August 1, 1959.

So from the railway revenue point of view, changes in this rate after 1955 consisted only in general increases on July 3, 1956, January 1, 1957, and December 1, 1958.

The crucial changes from the Crowsnest level in this long series of rate changes over 56 years were as follows:

1. 1908 to 1918: Competitive depression prior to close of World War I;
2. 1925: Adoption of \$1.28 level when 1897 Agreement cancelled in respect of westbound movement;
3. 1950: Cancellation of commodity rate for implements.

All other changes were formula actions for rates generally or for the class rate scale or general to eligible "bridge" traffic.

The final result, in May 1960, is a rate to the railways of \$3.39 and to shippers of \$2.83, being respectively 250 per cent and 192 per cent above the level provided in the Crowsnest Agreement.

Other Westbound Commodities

Exhibit 49A[2] throws some further light on the lapsed westbound provisions of the Crowsnest Agreement. For most of the articles in the list are shown:

1. the rate provided for in the Agreement (September 1899),
2. the crest of the post World War I increases (September 1920), and
3. the rate on April 25, 1960.

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[1] Normal here means "bridge" reduction not made.

[2] Appendix A.

Increases today (shippers' rates) over Agreement levels are: binder twine 300 per cent; settlers' effects 218 per cent; iron bars 68 per cent; lubricating oil 31 per cent; paints 129 per cent. In the case of some other items inscribed "No movement", the applicable rates have been ascertained to indicate the following increases today of shippers' rates over Agreement levels: furniture 162 per cent to 222 per cent; apples 174 per cent; window glass 239 per cent; cattle 183 per cent; wire 138 per cent.

In further indication of the significance of the westbound provisions of the Crowsnest Agreement which lapsed permanently in 1925, the movements in recent years of the named commodities as related in the Waybill Analyses[1] have been examined. Nine of the ten years from 1949 to 1958 were analysed and published.

Agricultural implements and parts moved in the biggest volume and were recorded in each of the nine years. The average movement was 42 cars, which, on the 1 per cent sample basis, would suggest an annual movement of 4,200 cars. Some $30,000 annual average freight revenue (sample basis) was recorded. The indication of the historical table of rates on this commodity is that current rates are about three times the Crowsnest level. Thus, of the estimated annual freight bill of $3 million, only $1 million would be paid if, like grain, implement rates westward through Fort William were still covered by the Agreement. Conversely, the extra $2 million actually collected by the railways is indicative of the scale of their concern in deriving low and statutorily limited revenue from the carriage of grain.

Other westbound commodities, the movement of which may be noted in the Waybill Analyses with their annual average movement of 1 per cent or so are: cordage and binder twine 1 car, $833 revenue; window glass 2 cars, $2,520 revenue; fresh fruit 4 cars, $2,042 revenue; paper for roofing purposes 3 cars, $3,070 revenue; paints 2 cars, $1,930 revenue; livestock less than a car, $186 revenue; furniture (not necessarily all "household") 47 cars, $32,500 revenue. There are no items of "iron", as such articles in the Analyses are "iron and steel". Such possible items show 14 cars average per year, $20,300 revenue.

The revenue significance, if the rates could be traced, would probably be between double (as indicated by the railways' contention for grain requirement) to three times or a little more as reported for implements. As much as $6,300,000 of annual revenue on Agreement articles other than implements is suggested, but a conservative estimate (considering the lack of precise correspondence between some categories in the Waybill Analyses and the Crowsnest Pass Agreement) is perhaps no more than half that amount. Thus the foregone benefit since 1925 would be about as much again as that estimated for implements.

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[1] Prepared by the Board of Transport Commissioners of Canada.

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It is necessary, concerning the foregoing conjecture on the westbound portion of the Crowsnest Pass Agreement, to *caution* that only the CPR was party to that Agreement whereas the CNR may carry half the applicable traffic recorded from the Waybill Analyses.

Surviving and Cancelled Benefits of Agreement

The contrast for the grain is, of course, that since the post World War I rise and fall, the rate (14 cents Winnipeg to Fort William, 20 cents Regina to Fort William, etc.) has remained at 1899 levels. There are non-statutory grain rates, an example of which is that from Fort William to Toronto-Montreal. This rate was 25 cents per 100 pounds for twenty-five or more years before 1948, making a ton-mile revenue of .505 cents, very close to the Crowsnest level. The eastern rate is now 66 cents to the shipper, 71 cents (without the roll-back) to the railway, some 164 per cent and 184 per cent above the 25 cents level, whilst the western statutory rate is unchanged.

Thus a contrast of two important parts of the 1897 Crowsnest Pass Agreement.

Statutory Rates and the Railways

The accepted theory of ratemaking indicates that total revenue from the differentiated rate structure must be sufficient to cover railway operating costs and overhead, while the rate on each particular article or shipment must cover out-of-pocket costs for the shipment and make some contribution to fixed or overhead costs; and that the particular rates above the indicated floor must be such as to move the traffic. This last stipulation can be in the sense of meeting the competition of another carrier or more generally permitting a movement that would otherwise not take place or only in small volume.

There is thus a lack of precision in ratemaking. The rate structure as a whole, in relation to composition of traffic at a stage in time, may barely return variable and fixed costs and some surplus for development or it may generously do so. In inflationary periods, as since World War II, the situation has been and is likely to be a struggle to have revenues keep up to increasing costs of operation. Fast developing competitors affect blocks of traffic and particular rates to compound this chronic unsolution of railways' problems.

Similarly, any particular rate may just return variable costs and a bit more, or may readily cover total costs and then some. The freight classification is supposed to arrange articles of freight through this spectrum

from ample return to barely remunerative but, perhaps, large volume movements. But competition has made the intent of the classification in respect of freight revenue difficult to preserve.

Since 1897, more particularly in the second and third quarters of the twentieth century, railway rating and volume of business have been affected not only by the competition of other carriers but also by creeping inflation. The latter, making for the chronic cost-price squeeze confronting railways, was not characteristic of the gold standard[1] era, which terminated many years after the Crowsnest Pass Agreement was signed. During the generation following 1897, railways had problems of volume of business, but there was stability in the rate structure contributed to by a somewhat steady dollar and a quasi-monopoly situation.

In any case, any particular rate could be varied within a narrow range and fulfil the loose stipulations of good ratemaking. Thus, to reduce grain rates 3 cents per 100 pounds in two years was not necessarily to depress unduly those rates nor to distort the rate structure in any violent way.

Our review of the history of Crowsnest rates suggests that the applicable rates in the absence of that Agreement may not have been much different from 1902 to 1922. There is further room to speculate that voluntary or normally set rates on grain would have been similar until 1939 and therefore until 1945 or 1946, considering wartime controls were accepted on all sides. This view is contributed to by the existence of grain rates in the East very similar in ton-mile return to statutory rates until 1948. Even today "At and East" rates on grain are in some cases as low as will be elucidated later.

Railways' Submissions

The railways' representations before this Commission on costs of handling statutorily rated grain traffic and their contentions for a just and reasonable rate today of double the Crowsnest level, convey the impression that the carriers have lost large sums of money each year for many years under the statutory rates situation. The analysis they have submitted concerns mainly 1958 and for some purposes 1956 to 1958, and this analysis is being tested elsewhere in this volume.[2] Thus, evidence as to how much longer than three recent years such traffic has been a "losing" traffic will be indirect rather than derived from railway cost evidence already before the Commission.

[1] Against its virtues the gold standard had even greater faults, including the possibility of deflation.

[2] See Hay, D. H., *The Problem of Grain Costing.*

The immediately preceding reference to the history of Crowsnest rates and of the general rate level and their divergence suggests that the traffic was remunerative until 1946 and that the shift to unremunerativeness came, if at all, during only the last ten years or so.

"Solely Related Lines"

Extended commentary on the details of the several cost submissions of the railways is not given here. The "solely related lines" concept of the cost submissions is examined, however.

This was introduced by the railways primarily as an element in their cost calculations; the accounts for certain lines could be taken directly into statutorily rated traffic costs without statistical inference if the lines could be shown to be solely related to the study traffic. The presentation infers that such lines would be abandoned if relief on statutory traffic should not be forthcoming and remaining lines would constitute a workable railway system.

The analysis here is not primarily on the justification or otherwise of the criterion for cost purposes but rather on the geography of the matter and to some degree the consequences of abandonment pursued according to "solely related lines".

TABLE II—LINES IN THE PRAIRIE PROVINCES "SOLELY RELATED" TO THE HANDLING OF GRAIN, AS DESIGNATED, 1959, BY CANADIAN PACIFIC RAILWAY AND CANADIAN NATIONAL RAILWAYS

	Alberta	*Saskatchewan*	*Manitoba*	*Total three provinces*
CANADIAN PACIFIC RAILWAY				
Track miles, Dec. 31, 1958	2,643[a]	4,311	1,761	8,715
"Solely Related Lines"	381	1,773	474	2,628
Remaining track miles	2,262	2,538	1,287	6,087
"Solely Related" as per cent of total	14.4	41.1	26.9	30.4
CANADIAN NATIONAL RAILWAYS				
Track miles, Dec. 31, 1958	2,141[a]	4,410	3,146	9,697
"Solely Related Lines"	335	1,873	748	2,956
Remaining track miles	1,806	2,537	2,398	6,741
"Solely Related" as per cent of total	15.6	42.5	23.8	30.4

[a] Less 13 miles in each case for 26 miles of joint track—to eliminate double count.

Canadian Pacific Railway's "solely related lines" are in the following localities:

MANITOBA: 474 of the total 1,761 miles in the Province (26.9 per cent) are involved. Most of these are in the southwest and centre west, also part of a line north of Winnipeg into the Interlake area and two stubs in the centre south.

Besides the main line, two secondary east-west through lines would stay, if "solely related lines" were abandoned. Lines straight north and south of Winnipeg (along the Red River and Lake Winnipeg) would stay.

SASKATCHEWAN: 1,773 of 4,311 miles in the Province (41.1 per cent) are involved. These include most stub lines and some tertiary main or through lines, especially in the south.

ALBERTA: 381 of 2,643 miles in the Province (14.4 per cent) are involved. These consist of stub lines and alternate through lines between small centres. The through line southeast from Lethbridge to southern Saskatchewan (as far as Shaunavon) is included in "solely related".

Canadian National Railways' "solely related lines" are in the following localities:

MANITOBA: 748 of 3,146 miles in the Province (23.8 per cent) are involved. If abandoned, all lines in the south of the Province would go except: (1) the line south from Winnipeg to the United States border and lines east of it, and (2) the main line west and the secondary main line to Brandon and Regina (part west of Portage la Prairie 52 miles to near Brandon would go). Of two very close main lines (1 or 2 miles apart) Winnipeg to Portage, the more northerly would go. In the west of the Province (1) a stub line west from Hallboro 74 miles to Beulah would go, as well as (2) a somewhat duplicate line north 38 miles from Neepawa, and (3) a tertiary line west from Neepawa through Russell and to and beyond Yorkton, Sask.

SASKATCHEWAN: 1,873 of 4,410 miles in the Province (42.5 per cent) are involved.

If "solely related" lines were abandoned, the main line system, including (1) Melville, Saskatoon, Biggar, (2) Humboldt, North Battleford, Lloydminster, (3) from Brandon to Regina, Saskatoon, Prince Albert, (4) Regina, Melville, Hudson Bay to The Pas, (5) Saskatoon, Kindersley to Calgary, would be preserved.

Most of the lines and stub lines on the fringe of the railway's southwestern system in the Province would go. Also most lines south of Prince Albert and west of that city and north of North Battleford would disappear.

ALBERTA: 335 of 2,141 miles in the Province (15.6 per cent are involved). These are lines southeast of Edmonton including the one through Stettler forking to Drumheller and Hanna. To these are added two stub lines on the east connecting into the Saskatchewan system.

Abandonment in Relation to "Solely Relatedness"

"Solely related lines" have been worked out by each railway without regard to the other, it would appear.

Thus, there is no effect such as "you abandon in this area and I will abandon in that, so as to leave *some* service for each locality". On the contrary, the basis of the designation of "solely related lines" is that the line pass through an area mainly committed to grain and that the line not be a through route for long-distance traffic of a general nature.

There is some cumulative effect, therefore, when a policy of abandonment of "solely related lines" is postulated independently by each railway. This may be generalized as follows:

Southwestern Manitoba would be hit, with only two main lines of each railway remaining.

The effect in Saskatchewan is somewhat of a general thinning out. The cumulative effect is seen in the northwest and southeast.

The indicated abandonment in Alberta is only about half the extent of that in Manitoba (in respect of proportion of mileage affected) and only a little more than a third of the proportion in Saskatchewan. The overlap is slight as between the railways, partly because the zoning of the Province into a "CP south" and a "CN north" is more pronounced here than in the other two Provinces.

We have no indication of "solely related lines" of Northern Alberta Railways. Thus such CP and CN lines are even less than 14 or 15 per cent of all lines in that Province.

If railway rationalization be proposed for the systems in the Prairie Provinces, it should be worked out on a basis much wider than merely the "solely related" formula of the Railway submissions.

"At and East" Rates

These eastern rates are suspected of being in some cases as low as or lower than statutory rates and to be carrying traffic steadily. They are export rates. Their history and status can be elucidated in summary.

R. A. C. Henry stated: "On Grain received ex Bay, Lake or River ports, (export) rates have been published, for many years, in relation to

those in effect from Buffalo to Philadelphia and New York, and have necessarily reflected changes made in those rates from time to time".[1]

Apparently the intent is that it is Montreal and St. Lawrence ports which are made equal to Philadelphia and New York. Mileages from Buffalo to Philadelphia and Buffalo to New York are about 400. Port Colborne is the lake port most obviously competitive with Buffalo, being only 20 miles across the corner of Lake Erie; it is 424 miles by the Canadian route from Montreal. Nearly all other Lake and Bay ports are greater distances from Montreal, up to 563 miles for Walkerville. Toronto, Kingston and Prescott are, of course, shorter distances, and shorter than Buffalo-New York.

Apparently Boston and Portland are rated higher—about 1 cent per 100 pounds—than New York. Our Maritime ports, Saint John and Halifax, have been equated with Boston and Portland, though distances are much greater.

Buffalo	— Boston	494 miles	(approx.)
Buffalo	— Portland	588 miles	"
Port Colborne	— Saint John	894 miles	"
Port Colborne	— Halifax	1,191 miles	"

The "At and East" rate for shipments to these four ports is 24.75 cents per 100 pounds for wheat and soya beans, slightly more for other grains up to 29.69 cents[2] for barley and buckwheat. On the basis of wheat, ton-mile revenues are as follows:

		cents
Buffalo	— Boston	1.01
Buffalo	— Portland	0.83
Port Colborne	— Saint John	0.56
Port Colborne	— Halifax	0.41
Sarnia	— Halifax (1,278 mi.)	0.39
Goderich	— Saint John (948 mi.)	0.52

Crowsnest rates give ton-mile revenue of as little as .42 cents from Calgary to Fort William; .45 cents from Maple Creek easterly and .52 cents from Maple Creek to Vancouver; and about .50 cents on the average. Thus most "At and East" rates to Halifax are lower than Crowsnest rates, and the longest "At and East" CP haul—Goderich to Saint John—is about the same level (comparable with Edmonton to Vancouver and Qu'Appelle to Fort William).

Ton-mile revenues for the United States routes that provide the competition are about 1 cent or a little more.

[1] Henry, R. A. C., and Associates, *Railway Freight Rates in Canada*, a study prepared for the Royal Commission on Dominion-Provincial Relations, Ottawa, 1939, p. 136.

[2] The rate for flaxseed, at 47.28 cents, provides ton-mile revenue of almost 1 cent, well above Crowsnest levels.

The CPR in Part I of its submission to the Turgeon Commission, 1949,[1] dealt with this subject in part. CPR examples of cars of wheat shipped from Port McNicoll to Montreal and to West Saint John, N.B., showed net earnings per car-mile of 34.4 cents to Montreal and 19.9 cents to West Saint John. Net earnings per ton-mile were respectively .66 cents and .38 cents. The comment was: "The net earnings per car mile from Port McNicoll to Montreal are approximately at the 1948 system average of all traffic. The net earnings per car mile from Port McNicoll to West Saint John are substantially less than the average, namely 19.9 cents as compared with the 1948 average of all traffic of 35.0 cents per car mile. In view of both the car mile and ton mile and ton mile earnings it would appear that the rate from Port McNicoll to Montreal returns at least out-of-pocket costs but the rate to West Saint John does not provide sufficient revenue to meet out-of-pocket costs and is carried at an operating loss".[2]

The table of the CP submission is herewith brought up to date in Table III for average loads, freight rates, elevation and switching charges.

TABLE III—WHEAT, IN BULK, FROM PORT MCNICOLL, ONT., TO MONTREAL, QUE., AND WEST SAINT JOHN, N.B., FOR EXPORT, RATES AND EARNINGS, 1960

	From Port McNicoll	
	To Montreal	*To West Saint John*
1. Miles	448	915
2. Average bushels per car	1,815	1,815
3. Average weight per car—lbs	109,000	109,000
4. Gross rate per 100 lbs. (cents)	23.92[a]	24.75[a]
5. Earnings per car (dollars)	260.73	269.78
6. Less elevation charge at Port McNicoll—per car 1¼ cents/bu. (dollars)	22.70	22.70
7. Less elevation charge (¾ cents/bu.) at Montreal—dollars per car	13.60	—
8. Less switching at Montreal—dollars per car	9.00	—
9. Net earnings per car (dollars)	215.43	247.08
10. Net earnings per car-mile (cents)	48.00	27.00
11. Net earnings per ton-mile (cents)	.88	.495
12. Earnings per ton-mile based on line 5. above (cents)	1.07	.54

[a] "At and East" rate which includes cost of elevation at Port McNicoll and Montreal.

[1] Submission of the Canadian Pacific Railway Co. to the Royal Commission on Transportation, Part I, October 1949, p. 77-80.

[2] *Ibid.*

It may now be seen that the net earnings per car-mile to Montreal are 48 cents, or 7 cents less than the average for all traffic in the 1958 Waybill Analysis. The net earnings per ton-mile for termination at Montreal are .88 cents and at West Saint John .495 cents, a level slightly lower than most Crowsnest rates. It would appear that the CPR's recognition that these rates were insufficient to meet out-of-pocket costs, at least to West Saint John, would be even more emphatic today.

The volume of exports of wheat, oats, barley and rye from Saint John and Halifax has aggregated 26.5 million bushels on the average during the last ten years. A very high proportion of this may be assumed to have arrived at those ports on "At and East" rates.

Service Aspects

The railways have told the Commission that in 1958 some 8 per cent of the carloads of freight they originated was statutorily rated grain traffic; that such traffic comprised 10 to 15 per cent of their loaded car-miles, 19 to 26 per cent of their revenue ton-miles, and 6 to 9 per cent of their freight revenue.[1] All these percentages are more than doubled when statutory traffic is set against only that originating in Western Canada.

The railways state that the ratio of empty to loaded car-miles for statutory traffic in 1958 was between 57 per cent (CN) and 58 per cent (CP), and this compares with ratios of 52.5 per cent for the CN system and 51.5 per cent for the CP system.

This traffic is entirely loaded and unloaded by shippers and consignees, and the railway just moves the car along its track from loading point on industrial siding to similarly situated unloading point. However, such arrangements are characteristic of all carload traffic.

Western grain traffic was long considered highly seasonal, with the requirement of a big build-up by the railways of available cars in the West preparatory to each harvest season. Then the big rush and movement occurred until the close of the Lakehead harbours. The Wheat Board marketing system, and more particularly the congestion in all storages characteristic of many recent years, has resulted in the rail movement being much more even and presumably more normal and less costly for the carriers.

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[1] Ranges of percentages are from CN (lower) to CP (higher). See Joint Submission of CNR and CPR to the Royal Commission on Transportation—*Statutory and Related Rates on Grain and Grain Products in Western Canada,* October 12, 1959, p. 21.

The Bracken Report presents an indication of this in the following table:[1]

TABLE IV—AVERAGE MONTHLY MARKETINGS OF THE FIVE MAJOR GRAINS IN THE PRAIRIE PROVINCES, "CONGESTED" PERIOD, CROP YEARS 1952-53 TO 1956-57 AND "FREE FLOW" PERIOD, 1945-46 TO 1949-50

	Crop Years			
	Average monthly marketings 1945-46 to 1949-50		*Average monthly marketings 1952-53 to 1956-57*	
	(millions of bushels)			
August	32.1		29.7	
September	126.6	58.2 per cent of total (September–November)	57.5	29.8 per cent of total (September–December)
October	94.4		71.5	
November	45.2		57.3	
December	27.2		58.1	
January	20.5		39.0	
February	9.7		28.5	
March	15.0		29.6	
April	11.3		29.9	
May	20.1		43.2	
June	27.3		68.8	28.9 per cent of total (June–July)
July	27.1		112.1[a]	

[a] July average is probably inflated above the movement in that month, and part of this high figure more properly appertains to August. There was some leniency at the end of years when the initial price was due to fall (4 of the 5 years).
Report on *The Inquiry into the Distribution of Railway Box Cars*, by John Bracken, p. 99.

It may be noted that in the "free flow" period 58.2 per cent of marketings took place in the September-November quarter, and all other months had below average volumes; the low month, February, had marketings only 25.5 per cent of the average monthly volume of 38.0 million bushels; the high month September showed marketings 334 per cent of the average.

In the "congested" period, however, as many months were above average as below average, the low month, February, was 54.7 per cent of the average (52.1 million bushels); the high month, July, was 215 per cent of the average. The "congested" period averaged an annual volume one-third larger than the "free flow" period, but the range of monthly volumes of the former was only 83.6 million bushels as against 116.9 million bushels in the "free flow" period.

Rail receipts of grain at export position terminals are a more direct indication of the seasonality of the railways' task in moving western grain, most of which is at statutory rates.

[1] Table D-2-d, p. 99, Report on *The Inquiry into the Distribution of Railway Box Cars*, by John Bracken. Data in this table was provided by The Board of Grain Commissioners, except for the insert percentage marketed in the months noted.

The Bracken Commission of 1958 inquired into "the distribution of railway box cars for the movement of grain amongst country elevators at individual shipping points in Western Canada". It indicated that its problem arose from the very heavy crops since 1950 which, together with the Wheat Board's inability to sell all the wheat, oats and barley that were annually produced for interprovincial and export trade, led to the large pile-up of grain of recent years.[1]

In respect of the problem of congestion at terminals, the Commission found as follows:

> "A. That the railways have the task of providing the box cars necessary to permit the Wheat Board, as owner of the grain, to carry out its shipping programme from country points as outlined from time to time.
>
> "B. That they are not legally required to deliver box cars to shipping points in any particular order, or in any specific number at any particular time; that the law against discrimination and the desire to give good service and earn the goodwill of the public are the final determiners of railway practice in this connection.
>
> "C. That the railways are guided by (but not ordered by) the Wheat Board in the placement of cars at the different shipping points, by weekly statements issued by the Board showing the quota situation at each shipping point and the number of cars required at each to complete deliveries under the different quotas in effect.
>
> "D. That the railways co-operate to the utmost extent in meeting the Wheat Board's wishes but are their own final arbiters in regard to order and time of placing cars at the different shipping points.
>
> "E. That they do not have the legal responsibility for determining the distribution of box cars amongst competing elevators at a shipping point.
>
> "F. That they manifest concern lest any new regulations interfere with their efficiency and thereby increase their costs of transportation.
>
> "G. That they protest strongly against the undue delays that occur from time to time in unloading cars after arrival at the terminal points.

"It is our view that the congestion of unloaded grain cars at certain terminals from time to time arises from lack of co-ordination amongst the elevator companies, the railways, the terminals and the Wheat Board itself; that each of these interests in the exercise of its legal rights contributes unwittingly to this condition; that legal regulation might improve the situation, but that voluntary co-operation within the present legal structure would seem to offer more hope of rational procedure."[2]

The Commission recommended "that co-ordination among the elevator companies, the railways and the terminals be invited by the Wheat Board with a view to achieving by co-operation what has failed to be accom-

[1] *Op. cit.*, p. 57.
[2] *Op. cit.*, p. 61-62.

plished in the exercise of their legal rights by their individual efforts, namely, the mitigation of the wasteful and unnecessary pile-up of unloaded cars from time to time at the terminals or elsewhere."[1]

The Commission further observed on this point:

"A. That the Wheat Board has power to see that no more cars are loaded than can be unloaded without undue delay;

"B. That both the railways and the Wheat Board have the power to divert cars to different terminals;

"C. That the railways have the power in their own hands of placing no more cars for loading than they can see reasonable prospects of unloading."[2]

Comparative Grain Handling Methods - United States

The grain crop of the United States is larger and more varied than that of Canada and the proportion of it which is disposed of domestically is much larger. Getting it to export position is not the crucial task that it is in Canada. There are 175 million humans in the United States and they require much of the country's grain directly as flour, breakfast foods, beverages, etc., and indirectly as animal feeds. The average total haul is probably shorter than in Canada.

Along with this more heterogeneous pattern of grain production in the United States go higher railway rates for its movement, at least in relation to Crowsnest rates. This was the case 20 years ago when Crowsnest rates were probably not a burden and the more so now.

The basic United States grain rate structure has exemplified such fundamentals as:

1. rate equalization over various routings to broad market areas;
2. application of a single rate to all grains and to products;
3. such rate covering various privileges such as circuity of routing, diversion, stopping, storage, and mixing in transit.[3]

The basic United States grain rate structure can be illustrated by movement eastward from Great Plains states. Recognized terminal markets include Duluth, Minneapolis, Sioux City, Omaha and Kansas City. Somewhat farther east are other terminal cities such as Chicago, Peoria, St. Louis, Cincinnati, Toledo and others. Buffalo is a lake unloading point, and export ports are Baltimore, Philadelphia, New York and Boston.

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[1] *Ibid.*, p. 62.
[2] *Ibid.*, p. 62.
[3] These principles have, for the most part, their counterpart in Canada.

Initial rail shipment is at *local* rates, returning between 1.6 cents per ton-mile for over 1,000 miles to 2.25 cents for 400 or so miles. Further movement from terminals is at *proportional* rates about 70 per cent of the level of local rates, and intended to make a combination charge about equal to the appropriate through rate from loading point through and beyond initial terminal point to lake or ocean port or consumption point. The effect is much like in-transit privileges calling for payment of balance of through rate from transit point. Proportionals are the average of transit balances, and they may be assessed by any railroad, not just the inbound carrier.

From lake and other terminals there are *ex-lake* rates, both domestic and export, to Atlantic Coast ports and the latter are only slightly more than half the former. Similarly from terminals other than lake ports there are *proportional* domestic and export rates, in about the same relationship to each other (e.g., 100:55) as ex-lake rates. Such export rates return about 1.0 cent per ton-mile to carriers and domestic rates in the same territory nearly twice as much.

The competition of other carriers—trucks, barges and lake vessels—has begun to affect United States grain rates here and there in the basic scheme just sketched. "Here and there" means that competitive rates are instituted very selectively by railroads. This, indeed, is the nature of that category of railway rates, that they meet competition that is real or imminent.

Trucks have moved strongly into the initial movement from country elevator to terminal or distant feeding area. This trend is still under way. Of the principal reasons for this, among the stated advantages of trucks, *lower rates* are the most important. Other factors are easier L.C.L. movement, speed, flexibility and less damage. Truck movement involves passing up transit privileges, the importance of which may be small in particular situations.

Haldeman states:[1] "There is some room for rail rate reductions on grain before they reach fully distributed costs, and a considerable area for reductions before rail rates as a whole decline to out-of-pocket costs. . . . Barge rates and lake vessel rates on grain (are) well above computed costs. Truck rates usually cover out-of-pocket costs and a little more, since so much trucked grain moves as back-haul. . .

"Barge and lake vessels move grain for three to five mills per short ton-mile . . . They move grain beyond terminal or subterminal markets . . . For the rail movement of grain from Minot, N.D., to Baltimore, ton-mile earnings range from 12.5 mills to 22.5 mills per short ton-mile . . . Truck

[1] *Carrier Competition for Grain Traffic,* a paper presented at the 1960 Annual Meeting, National Association of Chief Grain Inspectors, Toledo, Ohio, May 11, 1960, by Robert C. Haldeman, Transportation and Facilities Research Division, Agricultural Marketing Service, U.S. Department of Agriculture.

charges vary but often are around 17 mills per ton-mile. From Baltimore to Europe, ocean vessel charges are well under one mill per ton-mile . . ."

Haldeman summarizes competitive rail rate reductions in the United States for 1958 and following years:

1. Eastern line export grain reductions from most grain origins north of the Ohio River and east of the Mississippi River to North Atlantic ports, all in reaction to Seaway competition.
2. Proportional export rates from Missouri River markets—Kansas City, Omaha, Sioux City—to ports on Lakes Superior and Michigan, reduced five to six cents.
3. Earlier, coarse grain rates, domestic and export, had been reduced to lake ports from selected areas of Iowa, Minnesota and South Dakota.
4. Local rates within 100 miles of Toledo reduced to meet truck competition to that terminal.
5. Local rates from specified markets in northern Minnesota, northeastern South Dakota and eastern North Dakota to Minneapolis and Duluth were reduced from 8.5 cents to 13.5 cents per 100 pounds, a substantial proportion of the total rate.

In most of these cases lessened transit privileges, restricted routing and higher minimum carload weights accompanied the reductions.

Parallel Canadian developments include numerous agreed charges for movement of grain from Bay ports to interior Ontario feed mill points and Ontario grain within the Province. This suggests trucks are in this movement and trucks are also moving grain grown in western Ontario to points east and north. The Canadian Waybill Analysis, 1958, shows eastern region grain movements average between 1.6 cents (wheat) and 3.9 cents (rye) per ton-mile revenue to carriers. This would include a mixture of local, ex-lake and export rates. The railway agreed charges related to competition with trucks for 50 to 150 miles from Bay ports average 3 cents per ton-mile.

The higher rail freight rates on grain in the Western United States in contrast to the Crowsnest scale in Western Canada should be considered against the higher prices available to grain growers in the United States.[1] These United States prices are related to the parity policy in that country and they involve subsidies from the Federal Treasury in most recent years. Prices of western Canadian grain are unsubsidized except as one might reason that some degree of subsidy is available from the Crowsnest scheme of rates. The recognition until now of grain growers in the national policy of the two countries has been different but positive in each case.

[1] Mid-July 1960 quotations, No. 1 Northern and equivalent $2.16 in Minneapolis and $1.67 in Fort William, Canadian currency in both cases.

Burden of Statutory Rates

The railway estimate of the burden of statutory rates may be noted in their detailed submissions on the subject. They have revenues of .48 to .50 cents per ton-mile and ask that they might get as much again. This is backed by an indication of variable costs averaging about .75 cents and total costs averaging 1.0 cent or a little more.

The burden, on this evidence, is at least .25 cents per ton-mile and perhaps more (on total cost considerations) up to somewhat more than .50 cents. Per annum, it is the equal of between half and all of the indicated deficit of some $70 million for the two railways. In the preliminary organizational meeting of the Commission in September, Mr. Sinclair for Canadian Pacific said, at page 101, that the statutory rate inequity "means something in the region of $35 million to $40 million in revenues as a minimum, and possibly more under today's conditions, year after year".

Such a conclusion assumes that the volume of grain offered for shipment would be insensitive to changes in the level of freight rates. So stated, this is questioned here. But perhaps it assumes more especially that relief to the railways could and would be given as a subsidy from the Public Treasury as proposed by the railways, and that therefore grain shippers' costs per bushel, per 100 pounds or per car, would not be increased and their propensity to ship grain would be unchanged as far as freight cost might influence it.

In any case, it is desirable to consider at least two points:

1. Would the volume of western grain traffic be stable in the face of higher (double or more) *public* rates if adjustment were made directly without subsidy?
2. Have Crowsnest and statutory rates always been a burden throughout 61 years, or need one consider only quite recent years to find when any burden may have developed?

To consider the first proposition—elasticity of demand for *rail* transport for western grain—we have cited a United States reference that truck rates for grain there "usually cover out-of-pocket costs and little more", and "truck charges vary but often are around 17 mills per ton-mile".[1] A direct application of this indicates that a rail cost of 1.0 cent per ton-mile would be lower than likely truck rates (based on cost) by .7 cents per ton-mile, and that traffic would therefore not be lost to competitors by a doubling of Crowsnest grain rates. There is the necessary caution that "so much trucked grain moves as backhaul", which might indicate occasional

[1] Haldeman, *op. cit.*

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lower than out-of-pocket charges by trucks for carrying grain, as backhaul cannot usually be avoided.

Would such higher rail rates affect the volume of production of each grain on the Prairies? If, as it is widely accepted, the incidence of freight rates is on the grain shipper, i.e., the farmer, and if such producers react rationally to costs, then the total effect of higher rates should be reduced production and therefore reduced volume of shipping. If this prediction is sound, then the railway cost-price position for western grain handling should be improved per unit as they anticipate, but the aggregate extra gross revenue they would derive in a year would be less than the doubling of current statutory rate revenue apparently expected by them. It might take more than one year for such a result and there might be improvements (or deteriorations) in world grain markets to obscure the effect.

Turning to the second question, when, if there is a burden, did this burden develop? If the railways have nowhere stated firmly that western grain rates were a burden for them from 1899, there are places where such a suggestion is presented. It is a contention which on indirect evidence, at least, is invalid. We have already indicated that a 3 cents reduction in 1898 to 1899 was probably done within the limits of good conventional ratemaking, as facilitating the movement of traffic is one of the objectives. The further reduction for the Manitoba agreement during the period before World War I must also be approved in conventional terms, which allow competition to be met as long as rates remain compensatory.

After 1922, Crowsnest rates were matched by several significant eastern grain rates *which moved traffic,* were voluntarily published by the carriers and should have been and probably were compensatory.[1]

During this same period we have the evidence of line extension in Western Canada, largely in territories that provided grain traffic or nothing. First main track in the three Prairie Provinces aggregated as follows:

		Gain
1906	5,966 miles	
1909	7,157	1,191 miles (4 yrs.)
1914	11,709	4,552
1919	14,688	2,979
1924	16,280	1,592
1929	17,571	1,291
1934	18,523	952
1939	19,389	866
1944	19,300	—89
1958	19,401	101

[1] Compensatory is here defined as returning direct costs and at least an appreciable proportion of overhead costs to the carrier.

By the beginning of World War II railway mileage in the agricultural part of the Prairies was stabilized. But almost annually until then lines were extended. This was a voluntary process on the part of the railways. They were looking for grain and associated traffic and building toward farms more distant and toward newly settled land. They were competitive with each other but they felt they could make money handling grain and associated commodities and they were in all likelihood correct.

There are those, however, who regard the current railway pattern on the Prairies as redundant to some degree and even some who think that the feverish building in the 1920's and 1930's led immediately to redundancy.

Any current situation of redundant lines does not, however, mean that the pattern was redundant in the twenties and thirties. New factors since then, besides increased costs of railway operation alongside fixed grain rates, include improved roads, improved and more numerous trucks, improved grain growing methods, changed grain markets and grain prices. Any study of rationalization of railway plant and of grain handling plant and methods should begin now with due consideration of likely future needs. There are several parties to the problem of rationalization and these include, besides the railways, communities along the line, elevator companies, producer controlled and private, the Wheat Board, provincial authorities responsible for roads, farmers and possibly truckers.

Statutory Rates in the Prairie Economy

Historical — The Grain Production Industry

The growth of the grain production industry over a period of many years can be illustrated by data for trends in wheat acreage, production and value.

Acreage has increased to more than three times the amount early in the century. The greatest acreage was planted in the two years 1949 and 1950—more than 26 million in each case. Since then there has been a decline to less than 21 million in 1957 and 1958, with a small increase in 1959. Crops have scarcely declined, however, as yields per acre have increased. The first half of the 1950's had crops of one-half billion bushels or more in all but one year and since then one-third billion bushels have been more typical, a decline in volume attributable to a slight decline in acreage and a larger decline in yield.

The acreage of today is comparable with that of the 1920's and of the period of World War II. In other periods, such as the 1930's and the first

decade after the war, acreage was higher. However, the 1930's were characterized by drought and crops were smaller than those on less acreage currently.

TABLE V—WHEAT AVERAGE ACREAGE, PRODUCTION, FARM PRICE AND VALUE, PRAIRIE PROVINCES, 1908-61

	Seeded acreage	*Average yield*	*Pro-duction*	*Average farm price*	*Total farm value*
	'000,000 ac.	bu.	'000,000 bu.	$/bu.	$'000,000
1908–10 (3)	6.8	17.1	116	0.80	93
1911–15	10.6	21.2	225	0.75	169
1916–20	15.7	15.5	244	1.48	361
1921–25	21.0	16.3	342	0.91	313
1926–30	22.9	18.0	411	0.85	351
1931–35	24.7	12.3	303	0.46	140
1936–40	25.6	13.3	341	0.64	220
1941–45	20.4	17.4	356	1.04	370
1946–50	24.5	15.1	370	1.60	590
1951–55	24.4	21.6	523	1.42	747
1956	22.1	25.0	551	1.24	682
1957	20.4	17.8	364	1.28	465
1958	20.2	17.1	346	1.32	456
1959	22.6	17.7	399	1.19	474
1960	22.6	20.8	470	1.14	537
1961	23.2	10.4	240		

The Income Position of the Prairie Farmer

The farm income situation as it developed during the last 35 years may be shown for the three Prairie Provinces:

In the tables below farm income from those grains qualified for statutory grain rates is shown by annual averages for five-year periods since 1925. All other farm income is similarly shown and the proportion of each to total farm income is indicated. This is almost "crops versus livestock" income, but such minor Prairie crops as potatoes, vegetables, sugar-beets, grass seed, rapeseed, etc., are grouped with livestock and products.

It may be observed that at the beginning of the period three-quarters of farm income in the three provinces was from grains—wheat accounts for more than half of grain income throughout the period. During 20 years this proportion declined to two-thirds, and then just over one-half, as the effects of drought and wartime production programmes were evident. Post-war conditions led to a resurgence of the relative importance of the grains up to 70 per cent for a year or so, but they declined once again to only

TABLE VI—AVERAGE CASH INCOME FROM THE SALE OF FARM PRODUCTS, PRAIRIE PROVINCES, 1926-60

	Income from five principal grains[a]	*Income from other crops, livestock and products*	*Total cash income from sales*
	$'000,000	$'000,000	$'000,000
1926–30	379	111	490
1931–35	132	71	203
1936–40	188	114	302
1941–45	374	315	689
1946–50	631	416	1,047
1951–55	794	470	1,264
1956–59 (4)	665	573	1,238
1956	753	489	1,242
1957	638	537	1,175
1958	626	515	1,141
1959	652	644	1,296
1960	628	693	1,321

PERCENTAGE OF TOTAL PRAIRIE CASH FARM INCOME

	Per cent	*Per cent*	*Per cent*
1926–30	77	23	100
1931–35	65	35	100
1936–40	62	38	100
1941–45	54	46	100
1946–50	60	40	100
1951–55	63	37	100
1956–59	54	46	100
1956	61	39	100
1957	54	46	100
1958	55	45	100
1959	50	50	100
1960	48	52	100

[a] Wheat, oats, barley, rye and flax.

slightly more than one-half in the last two or three years. This shift has been contributed to by increases in livestock income and decreases in grain income. The reasons have included (1) grain marketing quotas; (2) declining world grain prices; (3) increasing population and demand for livestock products in Canada.

One is tempted to predict that the relative de-emphasis of grain in the western provinces' agriculture will continue or intensify, for reasons similar to those cited for the trend to date. However, crop conditions and market conditions influencing price could make a sudden alteration or delay in the trend for any one year in the near future.

On the market side, the export of wheat has long dominated disposal of the crop; some 60 to 65 per cent of the annual disposition is in exports and has been steadily so through the 1950's.

TABLE VII—CANADIAN WHEAT DISPOSITION, 1936–61

	Total	*Domestic*	*Export*	*Export as per cent of total*
	(millions of bushels)			
1936–40	294	116	178	61
1941–45	458	165	293	64
1946–50	370	143	227	61
1951–55	470	158	312	66
1956–57	419	155	264	63
1957–58	479	159	320	67
1958–59	462	168	294	64
1959–60	425	148	277	65
1960–61	504	150	354	70

What are prospects in wheat marketing? A recent study[1] indicates they will be as follows:

"(a) In the short run assuming competition in reducing surplus stocks:

Exports .... 220-250 million bushels.
Domestic requirement .... 150-165 million bushels.
Total requirement .... 370-415 million bushels.

(b) Long-term demand (1980):

Exports .... 255-300 million bushels.
Domestic requirement .... 180 million bushels.
Total requirement .... 435-480 million bushels."

It estimates 20 to 25 million acres as being required for such crops.

Recent production (1957, 1958 and 1959) has been below the estimates, so that, on the wheat indicator, absolute decline in Prairie grain

[1] *Progress and Prospects of Canadian Agriculture*, by W. M. Drummond and W. MacKenzie, a study for the Royal Commission on Canada's Economic Prospects, 1957, p. 53.

production may not be in prospect. The likelihood of increase in livestock production and that of non-grain crops, responding to growing Canadian population, is very real, however.

Thus grain production for cash sale has become and is likely further to become less important in the agricultural sector of the Prairie economy. At the same time, the agricultural sector itself is becoming a smaller proportion of all economic activity in the three provinces. On the gauge of net value of production of the principal industries, the trend over 35 years has been as follows:

TABLE VIII—AVERAGE NET VALUE OF PRODUCTION, AGRICULTURE AND TOTAL, PRAIRIE PROVINCES, 1926–59

	Agriculture	*Total (with 7 other industries)*[a]	*Agriculture as per cent of total*
	$'000,000	$'000,000	Per cent
1926–30	549	787	70
1931–35	216	371	58
1936–40	350	586	60
1941–45	648	1,014	64
1946–50	896	1,549	58
1951–55	1,132	2,512	45
1956	1,188	3,229	37
1957	742	2,877	26
1958	787	3,065	26
1959	891	3,174	28

[a] Also forestry, fisheries, trapping, mining, electric power (all primary); and manufacturing and construction (secondary).

In the early part of the period studied, agriculture was the main industry on the Prairies—to the extent of over 70 per cent of the total. The 1930's ranged in the 50 and 60 per cent range (on reduced or deflated values). The war period saw a resurgence of agricultural values and their proportion in total activity. The steady decline in agriculture's share since 1954, indicated by five-year averages, actually commenced after 1948, when the high of recent years, 61 per cent, was recorded. Alberta oil was discovered then, and industrial developments flowing from that had a large share in the increase of segments other than agriculture since then.

The drop below 50 per cent for the agricultural sector occurred in the late 1930's for Manitoba, in 1950 for Alberta and in 1957 for Saskatchewan. The agricultural weight in Manitoba and Alberta now appears to be less than 25 per cent.

The same indication of declining relative importance of agriculture in the Prairie economy can be given by examination of employment (including self-employment) in agriculture and the economy at large (Table IX). In the short period during which the labour force has been systematically surveyed, since 1945, persons with jobs in agriculture have declined from a proportion of almost half in the total of persons with jobs to only 29 per cent in 1958. This has been a steady trend. It is notable that absolute numbers of persons with jobs in agriculture have likewise declined, as mechanization and consolidation of farms have proceeded. The trend seems to be still under way.

TABLE IX—PERSONS WITH JOBS IN AGRICULTURE AND TOTAL PERSONS WITH JOBS, PRAIRIE PROVINCES, 1946–60

	Agriculture	*Total*	*Agriculture as per cent of total*
1946–50	439	944	46
1951–55	358	931	38
1956	323	975	33
1957	305	988	31
1958	296	1,004	29
1959	284	1,036	27
1960	279	1,053	26

SOURCE: *The Labour Force, November 1945—July 1958*, Reference Paper No. 58, Dominion Bureau of Statistics, p. 156–159.

It follows from examining Tables VIII and IX together that per capita income of persons with jobs in agriculture is going up on the average. Whether or not this is sufficiently rapid to offset a rising price level would require more intricate analysis than has been made here. Crops and prices being what they are, it would vary from year to year.

Grain Growers' Divided Interest

The stake of western grain producers in statutory rates is offset by certain disadvantages. These disadvantages do not necessarily offset the advantage, generally taken to be substantial. And the disadvantages only apply if, as appears to be so, statutory rates are too low in relation to railway costs.

The disadvantages can be enumerated as follows:

1. Any net gain to the western farmer from his grain being shipped at less than remunerative rates is reduced by his inevitable sharing of such benefit with grain buyers, many of whom are outside Canada. He is not benefiting to the extent that he is generally considered to be.
2. Western farmers pay freight on materials they buy for business and domestic purposes and these are higher than they would be if grain rates were not statutory and were treated as other rail freight rates, i.e., held to fair and reasonable levels by the carriers regulated by the Board of Transport Commissioners. Reference to Exhibit 52[1] (estimated result for CPR of a general freight rate increase of 19 per cent, compiled in 1958) suggests that, if traffic now moving at statutory rates obtained double statutory revenue, rates on coal and coke and on non-competitive class and commodity traffic could be reduced 31 per cent and still return the same aggregate freight revenue to the railway.[2] Using the 1958 Waybill Analysis, a doubling of statutory revenue would permit a 21 per cent lowering of class and non-competitive commodity rates and still return the same total freight revenue to the railways covered in that Analysis.[3] Both these approaches

[1] Appendix B.

[2] See following tabulation:

	Estimated revenue	*Estimated increase*	*Previous revenue*
	$ million	$ million	$ million
3. Coal and coke	19.1	1.4	17.7
6. All other	152.6	23.2	129.4
Total			147.1
1. Statutory (doubling)			44.7
Balance			102.4
$102.4 million is 69 per cent of 147.1 million			

[3]

1958 revenue from class rates	$ 580 thousand
1958 revenue from non-competitive commodity rates	$2,132
Total	$2,712
Statutory (doubling)	567
Balance	$2,145

$2,145,000 is 79 per cent of $2,712,000

(Waybill Analysis and Exhibit 52) disregard competitive rates and agreed charges on the assumption that their level is compelled by circumstances in the transportation industry rather than by any statutory rates. This is probably an oversimplification inasmuch as the growth of the competitive segment of railway traffic has been affected by the "normal" rate level, which has probably been affected by statutory rates, and that the competitive sector would therefore have been different, i.e., smaller, in the absence of statutory rates.

3. Railway service may leave something to be desired. If the carriers may anticipate a fair return from other traffic and only a loss from Crowsnest traffic, their effort may well go into serving the other traffic. There are statutory requirements that grain traffic be well handled. Any suggestion that it is not cannot be readily substantiated. It is a subtle thing at best. The Bracken Inquiry into the Distribution of Box Cars (1958) was appointed in part to investigate this matter, but it found the problems of grain shipping just complicated enough, and the number of vital parties in the process just numerous enough that it did not assign blame to only one agency or even primarily to one.

4. If any subsidy from the Federal Treasury were to be instituted related to statutory rates, western farmers as taxpayers would have a fourth disadvantage.

Incidence of Freight Rates on Grain

A review of the theory and measurements of demand elasticity, supply elasticity and incidence (of a tax or a freight rate increase or a subsidy, etc.) and their applicability to marketing western Canadian wheat at current or increased rail freight rates, leads to the conclusion that the burden of increased rail freight rates on grain would not be wholly borne by grain producers if demand and supply elasticities at the farm are lower than unity, as is found to be the case by every competent investigator. This means that overseas customers, for example, will partly bear this burden, as will also suppliers of some factors of production.

A further conclusion, harmonious with the above and just as inevitable if the elasticities are low, is that any benefit of current Crowsnest rates—which benefit would derive from the rates being, as claimed, below the cost of performing the service—must now be shared by western Canadian producers with their customers (overseas and domestic) and perhaps with their

suppliers. These relationships and incidences must be so if the elasticities of demand and supply have been correctly gauged as "low".[1]

St. Lawrence Seaway Savings

Early in 1959 when it was known that the 27-foot St. Lawrence Seaway would replace the old 14-foot system, the Canadian Wheat Board increased its asking prices for wheat in store Fort William-Port Arthur by 5⅝ cents per bushel. In its 1958-59 report[2] the Board stated that it "felt that the saving in forwarding costs for wheat resulting from the Seaway should accrue to the advantage of the western wheat producer . . . The increase in Board asking prices for wheat in store the Lakehead, being in effect a saving in forwarding costs within Canada, did not affect Board asking prices for wheat, c.i.f. St. Lawrence ports, and as a result did not increase the cost of wheat moving via the Seaway to the overseas buyer . . ."

The obvious comment on this action, using the same concepts and logic as in assessing impact of possibly increased rail freight rates, is that, with demand elasticity for wheat being low even at Lakehead and seaboard, the policy was correct; less proceeds for a lower priced offer would have accrued than by holding the seaboard price steady.

Shipping Costs, Rigid and Flexible

The accompanying Table X shows Crowsnest freight charges along with other transportation costs of moving wheat from the Canadian Prairies to overseas markets for a period of 27 years. The tendency of most of the items to increase over time is apparent, as is the fixed level of the rail freight cost, Prairie point to Fort William. Relative to 1933-38 and 1946-50 the 1959 charges are up by the following percentages:

—	*1933–38 base*	*1946–50 base*
	(per cent)	(per cent)
Interior handling	56	50
Lakehead fobbing	75	31
Lake transportation freight	180	19
Ocean transportation	64	(−45)
Estimated total forwarding costs	50	(−16)
Crowsnest freight	nil	nil
Lakehead price	79	(− 3)

[1] Conventionally, elasticities below 1.0 are "low".
[2] Page 9.

TABLE X—ESTIMATED AVERAGE COSTS OF MOVING CANADIAN NO. 1 NORTHERN WHEAT FROM A MID-PRAIRIE POINT[a] TO THE UNITED KINGDOM, SEASON OF NAVIGATION, 1933–60

	1933–38	*1939–45*	*1946–50*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*	*1957*	*1958*	*1959*	*1960*
						(cents per bushel)							
Interior handling costs (Country elevation, inward weighing and registration, and selling charges)	2.887	3.000	3.500	4.500	4.500	4.500	4.500	4.500	4.500	4.500	4.500	4.500	4.500
Rail freight to Lakehead	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800	13.800
Lakehead fobbing (Elevation, outward inspection and weighing, warehouse receipt cancellation, and lake shippers' charges)	1.484	1.484	1.974	2.469	2.469	2.469	2.469	2.469	2.469	2.469	2.594	2.594	2.594
Lake transportation charges													
Freight	4.734	7.304	11.170	16.000	16.000	16.000	14.403	13.500	16.000	16.000	16.000	13.288	13.000
Other (Brokerage, insurance and bank charges)	.532	.624	.849	.861	.814	.776	.739	.735	.646	.636	.624	.645	.650
Seaboard fobbing (Wharfage, superintendence, broker, agent's commission)	.720	.720	.720	.738	.738	.988	.988	.988	.988	.989	.989	.989	1.016
Ocean transportation charges (Mainly freight, but also insurance, bank and interest charges)	9.444	32.308	28.276	43.965	22.011	19.947	21.573	29.513	34.388	22.296	16.046	16.076	17.049
Estimated average forwarding costs	33.601	59.240	60.289	82.333	60.332	58.480	58.472	65.505	72.791	60.690	54.553	51.892	52.609
Price in store Fort William	90.458	90.268	166.575	192.250	188.250	185.750	186.250	173.000	174.000	168.125	162.375	166.250	165.875

[a] Scott, Sask.

SOURCE: Based on Board of Grain Commissioners for Canada, *Canadian Grain Exports* (Annuals), 1954-55 to 1960-61.

Thus lake transportation is the item which has increased most over time and ocean transportation is the most variable and, for the most part, the largest element (Table X). Lake rates are regulated as to maxima by the Board of Grain Commissioners. Ocean freight is not regulated by any government, nor even by a steamship conference, because tramp vessels, for which there is a market from day to day, do most of the carrying. Tramps are characteristically very scarce or very plentiful. It will be noted that World War II, Korean War and Suez periods saw high ocean rates, about double the levels in non-emergency periods.

Whether one should ask why rail rates should be so immutable when water rates are both free and variable, or suggest that, with water rates such an unstable element in marketing costs, it is just as well that a more stable—statutorily fixed—element is available as an offset, depends upon point of view. There can be stability without fixity.

Furthermore, despite the fixity of Crowsnest rates, total shipping costs of wheat from a mid-Prairie station to Liverpool since World War II show a range of variation between $50\frac{1}{2}$ cents and $82\frac{1}{3}$ cents per bushel, the higher figure being 63 per cent greater than the lower. And although the high freight cost is associated in the same year with a high price at Fort William, it must be assumed that some of the burden of extra freight costs falls on producers, to provide less proceeds per bushel at the farm than would have been available with none or less freight increase. Against this, however, would be the probability that the same emergency situation making for inflation buoyed both the price and the shipping cost.

Public Policy Issues

The statutory grain rates, in their original form of contract rates to which the Dominion Government was party, have always been and remain matters of public policy. They have frequently been termed a charter of Prairie agriculture. The rates started in association with further encouragement to the Canadian Pacific Railway and provisions to ensure benefits from it to users of railway services. The vision was one of a western economy based on agriculture of a kind surrounding production of the export product wheat. This particular export trade was deemed to be and long remained a prominent element in the whole national economy.

It promises to continue important in trade. However, looking ahead through several years, grain production and sale may take a less prominent place proportionally in the West and more generally. Many farmers will be less committed in the future than in the past to the "wheat economy" only.

We have examined the likely effect of higher (say doubled) western grain freight rates. Whilst an increase would be felt in the ordinary course

of events by the grain grower, nevertheless his customer and perhaps some of his suppliers would perforce share the burden to some extent.

From one point of view the burden of statutory rates as they are is less than ever; that is in terms of constant dollars, be they those of 1899, 1925, 1948 or other years. But constant dollars are gauged by the general price level, and the wheat grower is primarily sensitive to the wheat dollar, that is to the price per bushel he can obtain for wheat. This has, unfortunately, been declining since about 1950, with however some tendency to a new lower stability. At the same time many costs (other than western rail freight rates) have increased on a per unit basis through the ten years or more under consideration. The main offset to this, and indeed inspired by it, has been more and more mechanization of farming procedures to achieve lower unit costs. It has presumably been a somewhat losing battle in the balance.

The railways have proposed a subsidization—of the grain grower—to the extent of the statutory rate freight bill to give the carriers a doubling of the revenue for carrying the traffic, and a return to them of their bare costs. They would get one cent per ton-mile against only one half cent available from existing rates. When queried as to method of payment of this subsidy, the railways suggest that it would be impractical to pay it other than through the carriers; they may be willing to take their chances of retaining the traffic if the subsidy went direct to shippers and rates were raised. At one cent per ton-mile, it is not clear that they need be anxious, but at 1.5 or 1.75 cents truckers might offer their services.

The railways intimate that other freight-payers would benefit from their augmented revenue situation following introduction of a subsidy, and that such freight-payers are paying unduly now to offset statutory rate losses.

It might be appropriate to recognize:

1. that returns on statutory traffic are indeed grossly (if not uniquely) low,
2. that grain shippers have in effect a bargain in western rail freight charges greater than in earlier years when Crowsnest rates were rather "normal" and
3. that the "wheat economy" does not and will not typify the Prairie Provinces as it did for two generations, because the production of special crops and livestock is increasing in the region, as is the output of industries other than agriculture.

The reasons for Crowsnest rates and in due course statutory rates are different or at least of a different degree of intensity in 1960 than in 1897 and 1925. The provisions of those eras are up for re-examination, and the presumption and indication are that the policy should be altered, in the direction of less rigidity and less disregard for changing values and diminishing purchasing power of the dollar.

Appendix A
Exhibit 49A

CANADIAN PACIFIC RAILWAY

COMMODITY RATES ON SPECIFIED ARTICLES FROM SPECIFIC POINTS IN EASTERN CANADA TO SPECIFIC POINTS IN WESTERN CANADA AT VARIOUS PERIODS[1]

Commodity	—	*Sept. 1 1899*	*Sept. 13, 1920*	*Present Rate*	*Remarks*
Furniture	From Woodstock, Ont. To Regina, Sask.	$1.25	—	No movement	Commodity rate discontinued 1917 and never re-established.
Binder Twine	From Hamilton, Ont. To Winnipeg, Man.	.715	.74	2.85	Negotiations for Agreed Charge now in progress to meet truck competition.
Apples	From Toronto, Ont. To Moose Jaw, Sask.	.85	1.065	No movement	
Window Glass	From London, Ont. To Portage la Prairie, Man.	.785	.845	No movement	Window glass now moves from a number of points in Eastern Canada (London is not a shipping point for window glass) to distribution points in Western Canada under an Agreed Charge. Glass also moves to Western Canadian points from Vancouver. Glass can also be imported via Churchill.
Household Goods (Settlers' Effects)	From Brockville, Ont. To Brandon, Man.	.39	.52	1.24	Questionable as to whether movement in any volume.
Iron Bars	From Hamilton, Ont. To Calgary, Alta.	1.37	1.395	—	Traffic moves under Agreed Charge No. 428 at $2.30 per 100.

COMMODITY RATES ON SPECIFIED ARTICLES FROM SPECIFIC POINTS IN EASTERN CANADA TO SPECIFIC POINTS IN WESTERN CANADA AT VARIOUS PERIODS[1]—*Conc.*

Commodity	—	*Sept. 1 1899*	*Sept. 13, 1920*	*Present Rate*	*Remarks*
Cattle	From Ingersoll, Ont. To Weyburn, Sask.	.81	.92	No movement	
Lubricating Oil	From Montreal, Que. To Edmonton, Alta.	1.72	1.55	—	Traffic moves under Agreed Charge No. 152 at $2.25 per 100.
Paints	From Windsor, Ont. To Regina, Sask.	1.07	1.115	—	Traffic moves under Agreed Charge No. 135 at $2.65 minimum 24,000 lbs.; $2.45 minimum 40,000 lbs.
Wire	From London, Ont. To Saskatoon, Sask.	1.325	1.17	No movement	
Woodenware	From Woodstock, Ont. To Winnipeg, Man.	.715	.74	No movement	

[1] As requested by Mr. A. V. Mauro, Transcript of evidence, *Hearings*, December 7, 1959, Vol. 12, p. 1636–1638.

Appendix B

CANADIAN PACIFIC RAILWAY

ESTIMATED RESULT OF A GENERAL FREIGHT RATE INCREASE OF 19%
(25¢ per ton on Coal and Coke)

(1) Type of Traffic	(2) Estimated Revenue November 1, 1958 to December 31, 1959	(3) Percentage of Total	(4) Amount of Increase	(5) Estimated Revenue Yield in Dollars November 1, 1958 to December 31, 1959	(6) Percentage of Total
	(Millions)				
1 Grain and Grain Products at Statutory and Related Rates	$ 44.7	9.38	No Increase	$ —	—
2 International, Overhead, Import-Export and Other Related Rates	141.1	29.62	U.S. Increases Applied	—	—
3 Coal and Coke	19.1	4.0	25 cents per ton	1,425,000	4.52
4 Competitive Rates	58.7	12.32	19%	5,576,000	17.67
5 Agreed Charges	56.0	11.75	See Note	553,000	1.75
6 All Other Freight Traffic	152.6	32.03	19%	23,195,000	73.53
7 All Freight Traffic	472.2			30,749,000	
8 Miscellaneous Traffic subject to Freight Rate Increases	4.2	.90	19%	798,000	2.53
9 GRAND TOTAL	$476.4	100.00		$31,547,000	100.00

NOTE: Estimated Revenue Yield is calculated by applying 19% increase to Agreed Charges containing Escalator Clause.

Review of Federal Transportation Statistics

by

D. ELDON

OTTAWA 1961

53744-9—27½

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Review of Federal Transportation Statistics

Recommendations

Conceptual Basis

1. Transportation is a significant phase of the production processes of Canadian industry. Accurate and consistent information should be given promptly to the public to permit analysis of the efficiency of transportation services and their role in our economic life. The 1960's will be a decade of increasing competition in world markets, and Canadian industry will require efficient, low-cost transport in its drive to retain and expand exports. The 1960's will also be a decade of increasing competition and continuing technological change within the transportation industry itself. Therefore, the Government of Canada should devise a programme to meet the statistical needs of a foreseeable future in which public attention will centre on competition in transport and competition in world markets.

2. In this environment, the public will require more information about transport services which are most likely to grow in significance—trucking, air-cargo and mixed-media traffic. Also, the public will need more information on the relative efficiency of the different means of transport and the extent to which governments subsidize them. Greater emphasis must be placed on provision of comparable, internally consistent, historically continuous statistics of traffic by road, rail, pipeline, water and air.

Canadian Industrial Freight Traffic Survey

3. A Canadian Industrial Freight Traffic Survey, similar to that which forms part of the Census of Transportation now awaiting provision of funds by the United States Congress, would help to meet these needs. The Survey would be taken from documents retained by shippers of freight. Appropriate techniques for sampling the required information could be developed by the Dominion Bureau of Statistics, initially for important industries with a manageably small number of respondents, and later for all mining, processing and manufacturing industries. From the Survey, statistics of the volume of traffic moving by each carrier could be developed, with a breakdown according to commodity, region of origin and destination of shipments, and revenue collected per ton-mile. A full survey could be taken every ten

years and linked into the decennial Census of Industry so that total shipments by industries could be obtained. Such information would assist in preparation of annual statistics based on sample surveys in intercensal years. If improved interpolations proved to be necessary, a full survey could be conducted every five years instead of every ten.

New information provided by the Survey would make possible greatly improved analysis of traffic handled by competing carriers, and of the potential economies from through routing of traffic. For the first time traffic statistics would be available with commodity information uniform for all carriers and comparable with other statistical series, such as the international trade statistics, which are prepared according to the Standard Commodity Classification of the Dominion Bureau of Statistics. A Canadian Industrial Freight Survey would provide the statistical material required for further analysis of the role of transport services in the location of industry and in production processes. Statistics from the Survey would improve forecasts of traffic in important commodities, and estimates of carriers' future costs and appropriate rates.

Passenger Traffic Survey

4. In the interest of more efficient handling of passengers, a Passenger Traffic Survey should be devised to provide statistics of passenger flow between various regions by each means of transport. The Survey, to be conducted every five or ten years, would be based on reports from carriers, hotels and motels, and from the passengers themselves. Resulting information on passenger traffic patterns would be useful to the carriers and to industries depending on travel and tourists. Also, statistics from the Survey, in conjunction with improved statistics of commercial truck traffic, would make it easier to decide on the proper allocation of costs of highway construction and maintenance to private and to commercial users.

Index of Freight Rates

5. The pricing of transport services is so significant in competition among carriers, in public regulation of the industry, and in the costs of important manufacturing and primary industries, that an Index of Freight Rates should be designed to fill a gaping hole in our present statistics. Separate indexes should be published for rates charged by each type of carrier—rail, truck, airlines and shipping companies—with appropriate sub-indexes for regional movements and for important commodity groups. For rail traffic, an Index for the years 1954 to 1960 could be prepared from the annual *Waybill Analysis* of the Board of Transport Commissioners. Subsequently, most of

the information needed for constructing an accurate Index of Freight Rates for all media of transport would be available from a Canadian Industrial Freight Traffic Survey.

Improvements to Existing Statistics

6. Existing statistical publications relating to transport should be re-examined from a conceptual standpoint by the Dominion Bureau of Statistics. If new information on traffic becomes available through an Industrial Freight Traffic Survey, it may be used to improve some existing statistics and to supersede others. Each statistical series published should fill a need in the over-all programme. Unless re-examined periodically, statistical publications tend to immortality. A re-appraisal could eliminate redundant statistics, such as some of the tabulations published so late in *Railway Transport,* or result in the overhaul of a meaningless publication like *Water Transportation* which lacks a positive conceptual definition of what constitutes the Canadian shipping industry.

The overhaul of existing statistical publications would be greatly facilitated by establishment of a Committee on Transportation statistics under the chairmanship of the Dominion Statistician or his nominee. Representatives of the Dominion Bureau of Statistics should be assisted on this committee by representatives of the carriers, or the federal and provincial regulatory authorities, and of important industrial users of transport statistics.

7. Most of the existing statistical series dealing with traffic should, however, be continued in basically the same form. Traffic statistics prepared according to the commodity classification of the Association of American Railroads will still be useful in comparisons among railways. *The Waybill Analysis*: *All-Rail Carload Traffic,* published annually by the Board of Transport Commissioners, is sufficiently accurate to be of value to a number of users of statistics in its present form. The size of sample in the Waybill Analysis should only be increased if this proves necessary in order to construct annual statistics for the proposed Canadian Industrial Freight Traffic Survey. Although the method of preparing the Waybill Analysis publication need not be changed, responsibility for its publication should be shifted to the Dominion Bureau of Statistics.

Speed of Service

8. Speed and frequency of service provided by different carriers is an important aspect of transport output. The need for speed explains the growth in air cargo, for instance. Yet no statistics exist which give any useful

information on speed and frequency of service. Sampling techniques should provide a means of developing useful statistics on the time element in transport service.

Integrate Passenger Statistics

9. Statistics of passenger traffic now scattered through a number of periodicals should be integrated in one publication. In this publication should be incorporated the results of the Passenger Traffic Survey.

Equipment Inventories

10. Inventories of plant and equipment of railways, truckers, airlines and shipping companies should be related to the investment or expenditure involved. The cost of the dieselization programme, for example, should be shown against the quantities of diesel equipment and plant acquired by each major railway. The investment in aeroplanes and other equipment by major airlines should also be published.

Technological Change

11. Some statistical series, such as locomotive-miles, become outdated with technological change. Horsepower-miles would more accurately provide a homogeneous measure of work done when the character of a locomotive is changing. There are many different measures of output and efficiency in the transport industry and such statistics are easily misused. An explanation of the uses and limitations of statistics of output and of technical and economic efficiency could usefully be included in the text of statistical periodicals containing such data.

Labour in a Time of Technological Change

12. Continuous and detailed statistics of employment, hours, and wages in the transportation industry are particularly important when labour is affected by technological change and automation. Historical continuity in statistics of railway employees' earnings and hours was destroyed by a change in the occupational classes and in the method of reporting earnings and hours at the end of 1955. An "hours worked" basis was substituted for "hours paid for". The railways should make available to the Dominion Bureau of Statistics for publication information on hours paid for and average compensation per hour paid for on a basis permitting comparisons of earnings and hours in each occupational category with data published prior to the end of 1955. Also data should be available in this form to permit comparison

with other statistics of hours and earnings published by Dominion Bureau of Statistics for other industries. Comparable statistical series of employment, hours, and earnings should also be published for other carriers—trucks, airlines, shipping and urban transit. Statistics of unemployment of transport workers would also be useful.

Carriers' Costs

13. There is some demand for publication of the cost to carriers of handling freight and passengers between specific points. Statistics of the cost of particular transport operations are usually subject to the difficult problem of allocating sizeable joint costs. A formula could be devised by the Board of Transport Commissioners for making an arbitrary allocation of expenses to passenger and to freight service, or to intercity and suburban passenger traffic. Certainly it is important that the carriers themselves and the Board of Transport Commissioners have as accurate information as possible on the specific costs of moving passengers and freight in particular cases. It is not, however, advisable to give shippers of freight a weapon for completely undermining the "value of service" principle in railway ratemaking. If shippers knew exactly the costs of the carriers, they could use the information in raising objections to all rates above the "cost of service". Therefore, while improvements in cost determination by the carriers and the regulatory authorities should be encouraged, it is not in the public interest to publish estimates of "out-of-pocket" or variable costs of carriers handling particular types of traffic. The same objections do not, however, apply to the *prices* of transport services, for which more statistics are needed.

Specialized Industries

14. Certain specialized types of transport are likely to become increasingly important, and they could well be treated as distinct industries meriting publication of special statistics. Trucking of milk, automobiles, and livestock, tanker fleets, furniture moving, and freight forwarders, all fall into their own distinct categories, and it would be useful to begin publication of some statistics on the operations of each of these groups. In the warehousing and storage of goods, there are also some distinct categories which merit separate treatment, one example being customs sufferance warehouses.

Subsidies to Transport

15. While considerable information is now available on subsidies to railways, statistics of direct and indirect subsidies by governments to other forms of transport should be published. Sufficient information should be

developed on traffic flows of commercial trucks and private motor vehicles and passengers to permit better studies of the extent to which different forms of highway traffic either are subsidized or pay their share of road costs through taxes and fees to governments. Also, it would be valuable to develop statistics showing the extent to which services utilized by airlines are subsidized. A subsidized carrier has an advantage in competition with other carriers. There is a cost in terms of efficiency in encouraging traffic by subsidies to move through channels it would not otherwise use. In view of the importance of handling traffic wherever possible by the most efficient means, the public should know the extent of subsidies to different media of transport and to specific companies.

Accidents

16. In addition to the existing accident statistics for each means of transport, it would be useful to include the cost of damage to persons and property and also the expenditures by governments and other organizations for prevention of specific types of accidents.

Time-Lags

17. The Dominion Bureau of Statistics should study the time lags in the production of annual publications dealing with transport. The average delay in publication of annual transport publications after the close of a year is more than six months. Long delays in publication reduce the usefulness of the information published, and any speeding of publication enhances the value of the statistics. Introduction of improved data processing equipment is not the only answer to long delays in publication, because the delays happen anyway. Problems of securing prompt publication should be attacked vigorously whether they arise from slow reporting by respondents to the Dominion Bureau of Statistics or from conditions within the Bureau (notably a chronic shortage of staff).

Cost of Programme

18. The cost of this Programme of Transportation Statistics is extremely difficult to determine—impossible, in fact, until the new and improved statistical series are designed and methods worked out. The exact design of the programme is a matter for statistical experts in sampling and statistical methods in the Dominion Bureau of Statistics. The cost of the programme will also depend upon whether changes are introduced all at once or over a period of time.

Responsibility for Publication

19. Responsibility for the publication of statistics by the Government of Canada belongs primarily to the Dominion Bureau of Statistics. If a well co-ordinated statistical programme is to be administered by the Government, it should in all important respects be carried out by this statistical agency of government. It is true that individual government departments and boards must prepare statistics for their own internal use tailored to their specification. This is true also of business firms in regard to transport statistics. The published statistics are never quite adequate for every use, and so private statistics for internal use become necessary. The danger is that the statistics produced by a board or department will supersede those of the Dominion Bureau of Statistics. A board or department may argue that it has greater technical ability at its disposal than the Bureau. This may be true, but the statistics produced for public use by another body apart from the Dominion Bureau of Statistics may be less satisfactory from the standpoint of statistical validity and from the standpoint of comparability with other series. It is recommended, therefore, that Dominion Bureau of Statistics publish all of the transport statistics issued by the Federal Government in the form of periodicals. The annual *Waybill Analysis* now published by the Board of Transport Commissioners may be processed in its present manner, but the Dominion Bureau of Statistics should take responsibility for publication of this and all other regular statistical series.

Chapter 1

Uses of Transportation Statistics

To what extent do the transportation statistics published by the Government of Canada serve the uses which they might be expected to serve? This volume attempts to answer that question. The first necessary step in the accomplishment of this aim is to describe the uses of transport statistics, and the second is to describe what the existing statistical series contain. It should then be possible to match the present with the ideal situation and to speculate on what statistical feats are necessary to bring the two closer together. In matching ideal with actual situations, it is usually realistic to take a long view. In the case of transportation statistics a long view (of 20 years or so) provides the particular advantage of allowing time for full blossoming of advanced techniques for collection and processing of data with the use of high-speed electronic computers and related devices. The applications of this technology by the carriers and the statistical agencies of government are now only in bud, not in full bloom.

Transport as Part of the Production Process

The uses made of transportation statistics relate to a great variety of needs, but we can sum them up by saying that statistics are needed for an understanding of the transportation industry in itself and, almost more important, to clarify relationships between the transport component and other components of the economic process of production and sale of goods. Transportation has no separate life of its own. Transport carriers are instantly affected by any improvement or decline in the fortunes of every other industry. The close mutual dependence of other industry upon transport and of transport upon other industry creates a use for statistics which reflect the significance of transportation in the total production process of an industry. And also this dependence creates a need for industrial statistics which can be related to carriers' traffic and pricing of service. Existing statistics will be found to err on the side of treating transportation as an independent entity unrelated to other industrial processes.

Therefore, there is no harm in stating emphatically the importance of transport costs in relation to total production costs (especially in a country of vast distances), of transport charges in relation to costs and pricing policies of business firms, and the effect of transport costs on industrial location relative to markets and sources of supply. Published transportation statistics should be applicable to studies of such relationships.

Also, transport statistics should be (and are) available to relate transportation in a general way to total production of the economy and gross national product. Statistics of traffic or activity in the transport industry should appear in forms which permit their use as barometers of economic activity in particular industries and regions. And for all of these purposes it is important that comparable statistics of transportation "output" should be available for the different modes of transport.

At this point it is necessary to be more specific. Uses of transport statistics must be spelled out, both in regard to statistics of the transportation industry itself and statistics tying transportation in with other sectors of the economy.

Pricing of Transport Services

One of the significant aspects of transportation service for which published statistics should be available is pricing. The price of transportation service is of vital importance to industry and consumers who must bear the cost. The price obtained by the carrier for transportation service significantly affects the revenue position and financial welfare of the carrier. Furthermore, the price of transport service is to a large extent regulated by the Government for good economic reasons such as the prevention of ruinous competition

among firms with a heavy investment in fixed plant, and the prevention of unjust discrimination where the public might be at the mercy of a monopolistic carrier. Therefore, the pricing of transport service is something in which a remarkably large number of people have an important interest—almost all business firms, the consuming public, the regulatory agencies of government, and the carriers themselves whether they be truckers, railways, shipping companies, pipeline companies or airlines. The price of transport services is of key importance in the affairs of the transportation industry itself and in its relations with the rest of the economy.

As a result of this, one might expect that there would be considerable information in the published statistics dealing with freight rates and the average revenue per ton-mile (or some other measure of transportation output) collected by the carriers. One would anticipate that some statistical measures would be available for comparing, for instance, the post-war increase in freight rates charged by trucks or railways for moving automobiles from plant to market and the increase in market prices of automobiles. As we shall see in the next chapter, there is no means of making such a comparison with present statistics. Also, statistics dealing directly with freight rates relate almost exclusively to grain. And there are extremely serious gaps in the statistics dealing with revenue collected per unit of railway output. The great importance of the pricing of transport services is so far not reflected in published statistics.

Price is one of the focal points in competition among carriers. Price is one of the means by which an efficient carrier with low handling costs can divert traffic to himself. Consequently it would be useful to have a substantial amount of information on the price of freight service and passenger service offered by different carriers. It would be useful to have an index of the price of various transport services which could be related to the many other wholesale and consumer price indexes published by the Federal Government. And it would be useful to have information on freight charges for specific products moving between specific regions so that transport costs could be related to other processing costs.

Economic Efficiency of Transport Services

Another need which should be met by an ideal programme of transportation statistics is the need to measure efficiency of transportation services. There are two aspects of efficiency for which statistics should be provided—technical efficiency and economic efficiency. Technical efficiency relates to the performance of trains, trucks, terminals, and the many mechanical operations involved in provision of transport service. Economic efficiency brings in the dollar sign; it implies the provision of optimum service at minimum cost. Improvements in technical efficiency are bound to improve economic efficiency

through a more economical use of resources. The measurement of economic efficiency involves the relationship between output of service and inputs of labour, materials, plant and equipment, expressed in terms of dollars. Cost per ton-mile, for example, is one of the statistics which may be used to measure economic efficiency, provided that the nature of the service rendered and the location of the movement of freight are properly specified.

Economic efficiency is not a simple thing to measure. For example, the goal of economic efficiency cannot be established simply as minimum total transport costs over a given period of time, or a minimum proportion of gross national expenditure for transportation. A larger outlay might provide a much improved service which would tend to increase the gross national product. More freight might under some circumstances be sent by air, for instance; even though the transport cost per ton-mile would be much greater, the speed of service might be so great as to enlarge greatly the market for a perishable product. Nor can economic efficiency properly be judged by the condition of a carrier's income statement. Under some circumstances the provision of non-remunerative services by carriers may stimulate output of manufacturing or primary industries in an advantageous way.

The proper measurement of economic efficiency may require a considerable array of statistics which delineates costs of service, amounts of service or output (and its location), and also some yardsticks of what efficient performance is. The possibility of making valid comparisons between carriers' costs of providing similar services is necessary for the analysis of efficiency.

Many of the statistics needed for the measurement of economic efficiency are already published. There are statistics of output in terms of railway gross ton-miles, net ton-miles and tons of freight. Comparable statistics are published for railway passenger service. For other carriers, there is generally less detail and more gaps. For instance, tons of freight shipped by water are available, but not ton-*miles*. Some of the output measures, especially for railways, are expressed also as averages per dollar of freight revenue (per ton of revenue freight, and so forth). The form in which carriers' *costs* are published though renders it almost impossible to relate the appropriate costs to output. The approach to publication of expense data is financial, not functional. This limitation is a severe one when it comes to appraising economic efficiency or performance relative to cost.

The trouble stems partly from the difficulty of getting any single measure of a carrier's performance or output. Transportation service consists of more than movement of a ton of freight so many miles. Another dimension of freight service in addition to distance and volume is time. Speed of service often counts, or no freight traffic would move by air. Loss and damage, which occasion delay and inconvenience, are another aspect of transport service, and the danger or lack of danger of such occurrences may influence the

shipper's choice of carrier. Special services performed by the carrier—refrigeration, assistance in loading and unloading, notification of arrival, delivery to the door, and the privilege of diverting shipments in transit—all are aspects of transport service or output. They enter into the carrier's costs. They are part of performance, a job well done or botched.

Because there is no single measure of transport service, even for one given mode of transport like railways, it is necessary to specify a considerable range of statistics for the measurement of carriers' output. We need statistics of volume of freight (tons, for example), of distance, of speed, and of special services. Some combinations of different aspects of output are possible, such as "ton-miles" which measure both volume and distance. But there is no single unit of output which can be devised to cover every aspect of output. There is no way of getting around the complex variety of statistics needed for proper measurement of output, and existing statistics probably do not go far enough in providing the variety needed. At the same time, current statistical publications might be improved by more explanation of what is represented in figures of tons and ton-miles and some of the more sophisticated concepts like "gross ton-miles per train-hour". The layman sometimes does not know whether he can use a particular concept for his purpose or not, and the risk of misuse is considerable. More interpretive text in the Government statistical publications would provide some chart through difficult seas like measurement of railways' output.

Then there is the added difficulty of measuring carriers' costs in relation to output or services. There are difficult problems of allocating joint costs. An arbitrary formula could be devised by the Board of Transport Commissioners for separation of freight and passenger costs, or for separation of intercity from commuter passenger costs. The resulting figures of cost would still be arbitrary, however wise the designer of the formula. Still, *trends* in the allocated costs might provide useful indications of whether passenger expenses, for example, are increasing more rapidly than freight expenses. Progress is not impossible, but the statistical results will always require the most educated and intelligent interpretation. The answer to what traffic is remunerative and what traffic is not will not be revealed with crystal clarity.

The problem of proper interpretation raises the question of what information should be published and what should be available only to the carriers themselves or the regulatory authorities. The misuse of published statistics can be mischievous. And some statistics easily lend themselves to improper interpretation. It is clearly in the interest of the Board of Transport Commissioners, for instance, to have all statistics of cost and output which may throw light on the efficiency of different carriers. This does not mean that the information must be published. Also, it is in the interest of competing carriers to know each others' costs. A knowledge of other carriers' costs

provides a useful yardstick for a railway or a trucker's own operations and pricing policy. From this standpoint, if some carriers' costs are published in meaningful form, then it is only fair that they should *all* be published—for trucks, ships, airlines, and pipelines as well as for railways. The error in this case could be in *partial* publication which could be to the advantage of the carriers who were allowed to keep their costs secret. Finally, it is clearly in the interest of shippers and business firms generally to know what the carriers' costs are for handling traffic between specific points. If this information is available, shippers have a weapon to beat down the freight rates on products for which rates are higher than the carriers' cost of service.

Publication of carriers' costs of providing specific services would assist shippers in undermining the "value of service" principle in ratemaking as regards the products they ship. It is in the public interest that transport service be provided at low cost to shippers, but is does not follow that the elimination of the value of service principle is in the public interest. Some rates in excess of carriers' average total costs are useful in compensating carriers for non-remunerative or low competitive rates which cover only variable or "out-of-pocket" expenses. Non-remunerative rates may be beneficial where the output of consumers of freight service is very sensitive to transport cost. Under some conditions imports may be displaced or additional production and employment generated by non-remunerative rates. In extreme instances where rates do not even cover variable cost, the benefits may be sufficient to warrant either a subsidy by the Government to this traffic or compensatory rates on other traffic less sensitive to transport charges. If the value of service principle is undermined sufficiently, the only alternative will be a government subsidy.

Accordingly, it seems wise to make available a considerable amount of information about costs and carrier output to the regulatory authorities, but to withhold the information from shippers. In practice the larger carriers can probably estimate each other's costs readily enough.

For regular publication, adequate information on *prices* of various transport services is sufficient. The statistics for measurement of various aspects of service or output should be available, but carriers' revenues from providing the services should be published in preference to the costs. The revenues are clearly defined, but the costs are difficult to define and often difficult to allocate. Moreover, the publication of revenue data makes possible comparisons of carriers' charges for similar services, without providing shippers with a weapon for securing reductions in freight rates. It is not expected, of course, that everyone will agree with this judgement about the wisdom of publishing carriers' costs. It is a controversial subject.

In conclusion, there is a need for statistics which measure and promote economic efficiency in the transportation industry. Comparable statistics of

the varied services or outputs of different modes of transport should be publicly available. Although a business machine may be packaged differently and so weigh differently when sent by air or by water, a ton or a ton-mile of freight is roughly comparable for different carriers. Gaps in such statistics should be filled.

Secondly, cost information which can be related to functions or services should be available to the regulatory authorities so as to promote realistic ratemaking and efficient transport. The carriers themselves seem to be increasingly cost-conscious in today's competitive environment and this development tends to improve efficiency in transportation. Actual publication of carriers' costs for specific services, however, is a different matter. Publication of such information may damage the carriers financially through increasing pressures for rate reduction.

The third recommendation in regard to statistics relating to economic efficiency is that a substantial amount of information be publicly available on revenues collected or prices charged by the carriers for their services. The information should not be entombed in a book of rates, but should appear in regular statistical publications in tables showing movements of freight (volume, distance, region and commodity) against revenue collected, and also in tables relating to revenues from special services.

Finally, some interpretation of the uses and limitations of data relating to carriers' output may increase the usefulness of the published statistics.

Technical Efficiency

The variety of technical operations in movement of freight and passengers through and between terminals results in a corresponding variety of statistics of carriers' performance. Appropriate statistics must be designed in the case of railways for utilization of motive power, loading of freight and passenger trains, adherence to schedules, terminal handling, car allocation, consumption of fuel and materials, and utilization of manpower. For air operations, the statistics should relate to airports and aeroplanes and the special equipment and problems of the airlines. For water shipments, harbours and canals enter the picture. Each means of transport has its own special equipment and character, and accordingly its own statistical requirements.

Many of the statistics relating to technical efficiency are used for internal supervision of performance. These are not necessarily the statistics which the public requires. Analysts of the transportation industry will, however, derive useful information from statistics of performance. Measures of output, such as gross ton-miles, measures of utilization of equipment, such as the percentage of serviceable locomotive days to total locomotive days, and

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other measures of capacity and "inputs" will be useful not only to the carriers themselves but also to outsiders who wish to study the transportation industry.

Forecasting Traffic

Statistics of carriers' output do not derive all their significance from the need to measure economic efficiency or technical efficiency. Detailed information about traffic, by commodities and areas, is of considerable use in market research. Forecasts based on traffic statistics can detect developing trends in industry, and assist firms in predicting business conditions and potential sales.

Also, forecasts of traffic are useful in estimating future costs of carriers. Costs of transport are related to volume and location of traffic. Forecasts of demand for transportation service can assist carriers and regulatory authorities in realistic pricing of transportation services. New trends in transport service and the degree of public acceptance of such services as piggyback, fishyback and containerized freight shipment can be studied if proper statistics are available. Both carriers and shippers will plan more effectively if data are available for forecasting and for appraising trends.

Although freight traffic has particular significance for the economy, the usefulness of studies of passenger traffic patterns should not be overlooked. Forecasts of passenger traffic trends are of value not only to airlines, railways, shipping companies and bus companies, but also to the tourist and hotel industries. Published statistics of passenger traffic in adequate detail serve an important purpose.

Subsidies to Carriers

Pricing policies of carriers, traffic volume and composition, and carrier efficiency are all related to the financial condition of firms in the transportation industry. In practice, the financial position of many Canadian firms engaged in providing transport services has been improved through the payment of subsidies by the Government.

Because the public must pay both the freight charges and the subsidies, they have an interest in the publication of financial statements by the carriers. Financial statements, the next chapter will show, are already available in considerable detail for rail and air carriers, but much less information is available for truck and water carriers. Also, the public has an interest in the amount and form of subsidies to transport firms. The most adequate information on subsidies is now available for rail carriers. Serious gaps exist in public information on subsidies to highway traffic, airlines and pipelines.

In some cases, the reason is that the element of subsidy is disguised or difficult to determine. In regard to highway traffic, there is a lively controversy on this continent concerning the extent to which commercial trucking pays through licence fees and other taxes its fair share of the cost of building and maintaining highways. A clear answer to this question depends upon an analysis of the composition of traffic on particular highways. In Canada there is insufficient solid statistical fact to make possible an analysis of commercial trucking and other traffic in relation to highway costs.

Where direct subsidies are paid to the transportation industry, such information merits inclusion in the published statistics. Sometimes, as in the provision of airport, harbour and canal facilities, owned by the Government, the element of subsidy is uncertain or difficult to determine. Where subsidies are indirect, it is in the public interest to provide statistics which make possible estimates of these subsidies.

Accident Statistics

Another area of public concern is accidents related to transport. Highway accidents are of particular importance in view of their frequency and seriousness. Airline and rail accidents also arouse public concern. Therefore, it is useful to publish statistics of accidents in the transportation industry, with appropriate detail concerning location and cause, and also statistics showing the cost of accidents. Present accident statistics are quite detailed, but give little information on the cost in terms of damage to persons and property. Another important part of the accident picture is the extent of government spending for the prevention of accidents and for safety measures.

Labour Conditions

Public interest also focuses frequently on labour conditions in industry. The transportation industry is no exception. It is desirable to have detailed statistics of hours, wages, employment and unemployment in the transportation industry.

Statistics of hours and wages, with information concerning paid holidays and overtime, should be published regularly for each region and means of transport. Furthermore, such information should be comparable with similar statistics for other industries, so that inter-industry comparisons will be possible. Such information should also be available historically over a substantial period of time.

In a time of rapid technological change in the transport industry, information regarding the effects of such change on employment (and unemployment) in particular occupations is useful public information.

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Urban Economics

So far, the transportation industry may appear to be considered an inter-urban rather than an urban industry. There is, however, no intention to omit accidents on city streets or labour conditions in urban transit companies from the category of useful transportation statistics. In addition, urban transportation is not only a significant industry in itself, but also is in some cases hardly separable from inter-urban transportation. Railways provide commuter services in large metropolitan areas, and so do inter-urban bus companies. Local cartage companies provide not only urban transport but also services which are tied in with inter-urban movements of rail freight. Taxicabs offer mainly an urban service, but will also carry passengers between cities as well. For a complete picture of the transportation industry it is necessary to have statistics of urban transport as well as of inter-urban transport.

In addition, statistics should be available to permit studies of the role of transportation in the economy of the large municipality. Traffic problems grow in seriousness with the growth in large agglomerations of population. Solutions to problems of urban congestion can be found only through a thorough understanding of the economics of urban transportation. Alternatives to expensive road construction programmes may be found in improved railway and bus commuter services, or subsidized extensions of mass transit facilities. Analysis of such problems and alternative courses of action depends upon the availability of adequate statistics of urban transportation. The kinds of statistics needed relate both to traffic patterns of public and private vehicles, costs and revenues of urban transit companies, and public expenditures on roads.

National Defence

Up to this point, only peacetime uses of transportation statistics have been considered. In wartime, comprehensive planning of transport movements to take account of war priorities demands adequate statistics of traffic and equipment for each means of transport. In a future war or defence emergency, electronic data processing might well secure a more efficient utilization of the nation's transportation capacity. Past statistics of inputs (plant, labour and materials) could be related to output detail so as to calculate production functions for the transport industry. Resulting input-output tables could be of great assistance in programming traffic for maximum results in an emergency. The necessary statistical base cannot be worked up in an instant. Extension of our peacetime statistics, further analysis of traffic patterns and costs, and applications of new data-processing techniques to

secure fast results will all improve our chances of effective mobilization of transport resources in a sudden national emergency.

Timeliness and Historical Continuity

In all statistics for whatever use, an important consideration is timeliness of the information when it is published. If statistics of transportation covering 1960 are not available until 1962, much of their usefulness may be destroyed. On the other hand, a rush to publish statistics without time for checking accuracy or securing delinquent reports may result in inaccurate information. Or fast publication may be secured at excessive cost. The importance of fast availability of statistics varies according to the use made of them. For forecasting traffic or economic trends, prompt availability of information is of considerable importance. For analysis of situations which change slowly, immediate accessibility to data has less importance. The statistics should be timed so as to meet the important needs within a reasonable time. Sometimes the provision of monthly or weekly data in less detail improves the timeliness. In other cases, detailed annual data may be significant even if not available promptly at the end of the year, whereas general data published monthly may not meet a real need. Through inquiries for information and comments on existing publications, the Dominion Bureau of Statistics gathers an impression of the importance of timeliness in publication of particular statistical series.

A further important dimension in statistical services is the element of historical continuity. For some purposes, availability of a historical series is not important. In other cases, the absence of a continuous time series renders fruitful analysis impossible. Historical analysis of statistics of traffic, finances of carriers, labour employed, and price of services is likely to be sufficiently common and important to warrant an effort to preserve continuous time series.

Sometimes it is difficult to preserve genuine continuity in a statistical series over a long period of time. A locomotive today is not the same as a locomotive ten years ago either in appearance, consumption of fuel, or performance. Accordingly, a locomotive-mile or even a train-mile today is not quite the same thing as it was in 1950. A long historical series of train-mile statistics may look homogeneous, but it is not. Technological change has interfered. Likewise, commodities change as time goes on, and today's automobile is not quite the same product as an automobile was in 1940. Also completely new products are added. New types of equipment and plant can introduce hidden discontinuities into statistical series. A huge investment in hump yards or diesel locomotives can result in a sharp decline in labour cost of yard switching or hauling a ton of freight, and the historical series of labour cost is misleading unless related to depreciation costs of yards and

locomotives over the same period of time. For all these reasons, historical continuity cannot be guaranteed.

At the same time, if the basis of a statistical series is changed to make it more accurate or useful in a modern context, it is usually possible to preserve historical continuity through continuing the series for a while on the old basis. Discrepancies then show up. Difficulties arise when the basis of a statistical series is shifted, but no bridge is provided between the old and new series.

Usefulness of statistical information is therefore dependent frequently upon the speed with which it becomes available and upon the possibility of comparisons with past years. This aspect of present transportation statistics will be considered in the appraisal of existing statistics in the next chapter.

Appraising the Usefulness of Statistics

Many of the uses of transportation statistics have been described in this chapter. Other uses exist, undoubtedly, which have not found a place in this description. Not all uses which statistics come to serve can be easily foreseen either. Sufficient has been said, however, about the needs which transport statistics serve to provide some criteria for judging existing statistics.

How do we decide then whether a given statistical series (present or proposed) is useful or not? Is not usefulness largely a matter of opinion? It is certainly true that there are difficulties in deciding when a statistical series meets a real need. Some experienced statisticians have found that the best way to get an answer is to quietly stop publication of a series. If no one complains, the statistics are useless and can safely be discontinued. If there are loud complaints, the statistician simply resumes publication and apologizes for the delay!

The method suggested is a little crude. It yields no information about the reason for a statistical series not being needed. It tells nothing about whether the statistics arrived too late to be useful, or whether they were too complicated, or poorly presented, or simply irrelevant to any need.

Logic will carry us only part way in deciding whether a given statistical series meets a need. Some statistics may be so inaccurate as to appear useless, but even so there are situations in which businessmen make accurate decisions using imperfect information. The statistics may appear inadequate and yet be better than nothing. Then there are many border-line cases where a series might be useful, but where nothing is really known about its actual use. The number of paid subscriptions to a statistical publication is some indication of usefulness, but some organizations and libraries subscribe to all government publications in the interest of having complete files. The publications may not all be actually used. Then too, a small number of subscribers may actually make highly significant use of a publication. A trade

association may use one copy of a government publication as a basis for a valuable piece of analysis distributed to 1000 members. Or a university professor may use some obscure statistical series in writing a useful book.

The next chapter begins with an appraisal of present transportation statistics using another method—a questionnaire to a sample of industrial firms which may be expected to have a use for transportation statistics.

Up to this point, we have described a number of needs for transportation statistics and have outlined kinds of information which could usefully be published. Among the uses for such statistics is the integration of transport cost and traffic data with information about other steps in the production of goods and services. Information on the pricing of transport services was also found to serve a presumed need. Statistical measures of output, of economic efficiency and technical efficiency should also be of value. Financial reports of carriers and statements of government subsidy should be published. Finally, the special needs of defence planning should be taken into account through development of advanced statistics of transportation inputs and outputs. In most instances, there is a need for comparable information for all the many different modes of transport. This is a complex industry affecting every region of the country, and therefore an almost bewildering variety and detail of transport statistics appear to be needed. In terms of the outline of uses here developed, we shall now analyse the existing published statistics with particular attention to important gaps and ways of filling them.

Chapter 2

Assessment of Existing Statistics of Transportation

Questionnaire to Traffic Officials

In July 1960 a questionnaire went to 25 traffic officers employed mainly by large manufacturing firms to ask them "How useful are the Federal Government's transport statistics to you?" The questionnaire is reproduced and the 23 replies are summarized in Table 1.[1] Questions in this questionnaire asked about the usefulness of existing statistics of transportation and also about the value of several suggestions for new statistical series.

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[1] Replies were received from the following organizations: Aluminum Company of Canada, Limited; Bathurst Power & Paper Company Limited; The British American Oil Company Limited; Canada Cement Company, Limited; Canadian Canners Limited; Canadian Gypsum Co., Ltd.; Canadian Industrial Traffic League; Canadian Industries Limited; Crown Zellerbach Canada Limited; Duplate Canada Limited; DuPont of Canada Limited; Federated Co-operatives Limited; The Glidden Company Limited; Hiram Walker & Sons Limited; Husky Oil & Refining Ltd.; Kraft Foods Limited; Lever Brothers Limited; Manitoba Transportation Commission; Northern Electric Company Limited; Robin Hood Flour Mills Limited; Standard Brands Limited; Swift Canadian Co., Limited; Union Carbide Canada Limited.

Replies indicated a greater demand for statistics published by the Dominion Bureau of Statistics on rail and truck transportation than for those dealing with other means of transport. Eight replies classed rail statistics as "very useful" and seven replies placed truck statistics in the same category. Only one respondent classed pipeline or urban transit statistics as "very useful" and four considered them of no use. Of course, it might be anticipated that industrial traffic officials would have less reason to use urban transit statistics than statistics of intercity transport. One question dealt specifically

TABLE 1—QUESTIONNAIRE WITH SUMMARY OF REPLIES FROM 23 ORGANIZATIONS

How useful are the Federal Government's transport statistics to you?

1. Do you subscribe to any of the transportation statistics published by DBS? No: 6 replies.

	Very useful	*Occasional use*	*No use*
Truck	7	4	2
Rail	8	3	2
Air	3	4	3
Water	3	4	2
Canal	3	5	2
Pipeline	1	5	4
Urban transit	1	2	4

2. Do you use the annual rail Carload Waybill Analysis published by the Board of Transport Commissioners? If so, is it:
   Not used: 5 replies.
   Useful in detail $\boxed{6}$; Useful in its totals $\boxed{4}$; Little use $\boxed{6}$

3. Do you subscribe to all publications of the Dominion Bureau of Statistics in all fields? Yes 3 ; No 19 .

4. How many of your employees are engaged in reporting information to the Dominion Bureau of Statistics? None: 6 replies.
   Full time 1 ; Part time 56 . (Totals reported by all respondents.)

5. Do you develop from your own company records traffic and transport statistics for your own use? Yes 16 ; No 5 .
   Please give details:

6. Would any of the following statistical services (if made available by the Federal Government) meet a need in your company? None: 5 replies.
   (a) Truck carloading figures similar to rail carloadings already published $\boxed{8}$
   (b) Volume of traffic by main commodity and origin and destination for:
   Rail $\boxed{11}$; Truck $\boxed{11}$; Air $\boxed{4}$; Water $\boxed{9}$
   (c) Cost to carriers of handling shipments between specific points by:
   Rail $\boxed{16}$; Truck $\boxed{17}$; Air $\boxed{6}$; Water $\boxed{14}$; Pipeline $\boxed{8}$

(d) Index of freight rates:
Rail $\boxed{13}$; Truck $\boxed{13}$; Air $\boxed{7}$; Water $\boxed{11}$; Pipeline $\boxed{6}$

(e) Piggyback and fishyback traffic analysis $\boxed{10}$

(f) Containerized traffic analysis $\boxed{12}$

(g) Statistics by teletype $\boxed{1}$

(h) Present statistics published sooner $\boxed{9}$

with the annual *Waybill Analysis: Carload All-Rail Traffic,* a publication of the Board of Transport Commissioners containing statistics of tons, ton-miles, average haul and revenues classed according to commodity and type of freight rate (*see* App. p. 506). Six of the 23 respondents found the detail in this publication useful, although it is based on a small sample (1%) of domestic carload traffic. Four found the more general or total statistics useful, six considered the publication of little use, and five did not use it at all. Two other respondents did not answer this question. Broadly speaking, the replies to questions concerning existing statistics indicated that truck and rail statistics (including the *Waybill Analysis*) are very useful and that at least a quarter of the traffic officials polled make "occasional" or more frequent use of the statistics in all categories of intercity transport.

A large majority of the firms sampled also prepare their own internal statistics of transportation. The nature of internal statistics varies from firm to firm. A number of companies prepare detailed statistics of freight loaded and unloaded, or shipped by each mode of transport. Tonnages shipped to warehouses and distribution points are commonly recorded. Some firms record loss and damage claims or demurrage charges or cost of local cartage services utilized. The need for internal statistics of these types could never be met by published statistics which are not intended to reveal the operations of individual industrial firms.

None of the respondents actually complained about the burden of reporting information to the Dominion Bureau of Statistics. Provided the replies are comprehensive, a total of one full-time employee and 56 part-time employees were engaged in reporting statistics for 23 firms. These numbers do not appear excessive—fewer than three per firm.

A large proportion of the traffic officials replying supported a need for additional statistical services. Greatest demand was for "cost to carriers of handling shipments between specific points" truck (17 replies), rail (16), and water (14). There was also a substantial demand for information on pricing of transport service; 13 replies indicated a need for an index of rail freight rates, 13 for an index of trucking rates, and 11 for a water rates index. Nearly half of the respondents wanted statistics on volume of rail and truck traffic by main commodities and by origin and destination. Also there was support for more data on some of the new developments in freight traffic—

containerized traffic (12 replies) and piggyback and fishyback (10). More than one-third of the replies showed a desire for earlier publication of present statistics.

All of these precise questions about needed statistics cover information not now published—gaps in the existing statistics. There is clearly a demand for information to fill these gaps in pricing of transport service, cost to carriers of providing service, details of traffic by commodity and by origin and destination, and detail of new types of freight movement. Amongst traffic officials, as indicated by this sample, there seems to be a fair degree of acceptance of present statistics, but also a demand for some new series.

Traffic officials are not the only users of transportation statistics by any means. A wider group of potential users—market analysts, government officials and economic consultants—could also be approached with the same questions. The traffic officials were questioned because they are a specialized industrial group working in transportation. Their interest in transport statistics, and therefore their probable response to the questionnaire, was judged to be greater than that of a more diverse group.

Coverage of Transport Periodicals

Several types of government publications may contain information on transportation. Some periodicals specialize in transport statistics. Such publications may be annual, like *Railway Freight Traffic,* or monthly, or even more frequent, like *Carloadings,* which the Dominion Bureau of Statistics issues four times a month. Most of the government periodicals dealing entirely or chiefly with transportation are produced by the Dominion Bureau of Statistics, but one notable exception is the annual *Waybill Analysis: Carload All-Rail Traffic* issued by the Board of Transport Commissioners. The specialized statistical publications almost always deal with a single mode of transport and few with more than one, except, for example, where truck operations of major railways are included in rail reports. Two exceptions, publications dealing with several modes of transport, are the periodicals *Travel between Canada and the United States* (monthly) and *Travel between Canada and Other Countries* (annual). Apart from these few examples there are no publications which successfully tie together the various means of transport. Existing statistics do not integrate the parts of the whole transportation industry in large measure, because statistical series published for the different means of transport are not comparable.

Included among the special publications on transportation for our purpose are periodicals dealing with warehousing and storage, and with production of transportation equipment. Warehousing and storage are closely linked to transport in actual practice. There is also a close relation between

industrial inventories and transportation service. And production of transport equipment—whether railway rolling stock or boats or bicycles—is important in the relationships between transport and the rest of the economy.

In addition to publications dealing specifically with transportation, there are many which deal only incidentally with transport. For example, the annual *Grain Trade of Canada* prepared by the Dominion Bureau of Statistics contains information on water and rail freight rates, on movements by water, rail and truck to grain elevators, and on quantities of grain stored in elevators. So much information relating to transportation and particularly storage is contained in the periodicals which deal chiefly with grain that these are listed in this study among publications in the Warehouse and Storage category.

The statistical content of all the publications dealing mainly or substantially with transportation is summarized in the Appendix, and exhibits representing exact reproductions of tables in these periodicals illustrate the form of presentation.

Annual Reports of Government Agencies

Also annual reports of some government departments contain statistics of transport in the form of distinctive series—not just a rehash of the ordinary statistical publications. An important example of this is the *Annual Report of the National Harbours Board* containing important statistics of traffic inbound and outbound from ports under the Board's jurisdiction. The *Annual Report of Board of Transport Commissioners for Canada* contains very detailed information on expenditures for protection at highway crossings and also detail of grade separations approved and contributions from the Railway Grade Crossing fund for automatic protection and improvements to view. For this and certain other information the Board's annual report is a source of detailed statistics not found in the regular periodicals of the Dominion Bureau of Statistics.

Another important report is the *Annual Report of the Canadian Maritime Commission,* containing material on ships in the Canadian merchant fleet, and charter rates. Statistics of Canadian-flag participation in carriage of Canada's overseas trade are included and also information on operations of Canadian shipyards.

The Board of Grain Commissioners also publishes a number of statistical tables based on reports received from all elevators licensed under the Canada Grain Act. Useful information on transport may appear incidentally in other reports of government agencies—such as details of subventions on coal paid under the Maritime Freight Rates Act, published in the *Annual Report of the Dominion Coal Board.* Then too, there are included in annual reports of government agencies financial statements of government bodies

dealing with transportation—The Department of Transport, the Board of Transport Commissioners, the St. Lawrence Seaway Authority, and the National Harbours Board. Amongst government agencies we may include the Canadian National Railways. Actually the Canadian National and Canadian Pacific both include statistical sections as well as financial data (balance sheets and income statements) in their annual reports. Annual and historical statistics of rail-line operations include much material found also in the Dominion Bureau of Statistics publications on traffic and revenues and expenses. A few statistics such as average speed of freight trains appear only in the annual reports of the two major railways.

The annual reports of government agencies are for the most part though only an incidental source of information on Canadian transportation. Main reliance must be placed on the specialized statistical series published regularly by the statistical agencies of the Government, chiefly the Dominion Bureau of Statistics. Accordingly, this report does not make any recommendation about the statistical content of annual reports of government agencies. It is considered that all important data should be provided in the regular statistical periodicals, whether or not there is some duplication with the departmental reports. For example, the *Annual Report of the National Harbours Board* contains material on ports which also appears in the *Shipping Report* published by Dominion Bureau of Statistics. Some of the information on charter rates found in the report of the Canadian Maritime Commisison might, however, usefully make its way into regular specialized transport publications.

Relation of Transport to the Rest of the Economy

In addition to the specialized reports on transport and the annual reports of government agencies which serve more than just a statistical purpose, there is considerable useful information on transportation in Dominion Bureau of Statistics and other government publications which deal either generally with the whole economy, or mainly with some other subject—with only incidental reference to transportation. These publications are significant in that they relate transportation to the rest of the economy.

One example is Taxation Statistics, published annually by the Department of National Revenue. Not primarily concerned with transportation, this publication shows financial data on taxable companies in the categories of railways, urban transportation and taxicabs, bus and other transportation, grain elevators, and storage and warehouse. The airlines may not like being lumped in with "Bus and other transportation", but on the whole the information in the publication is useful in relating taxable transport companies with corporations in other industries.

A number of publications dealing with employment contain incidental references to transportation, or some transportation category in the tables of statistics. A monthly employment index for transportation and for each of the important modes of transport appears in a monthly publication of the Dominion Bureau of Statistics, *Employment and Payrolls*. The same publication also states the average weekly wages and salaries and the number of employees reported in each of these categories. The information is provided in regional detail as well—by provinces and selected urban areas.

Information on average weekly hours, average hourly earnings, and average weekly wages appears in the Dominion Bureau of Statistics monthly and annual periodicals, *Man-Hours and Hourly Earnings*. Employees in "transportation equipment" and "electric and motor transportation" are covered here. Hirings and separations in transportation, storage, and the transportation equipment industries are reported in the semi-annual publication, *Hiring and Separation Rates in Certain Industries*. This is not a comprehensive list of transport data in publications dealing chiefly with labour and employment. Most of the Dominion Bureau of Statistics' publications on labour and employment contain a transport category. There are some gaps though. It is recommended that in the *Man-Hours* publication railways, trucks and shipping be included. Employees in each of these categories should be shown separately, along with employees in transportation equipment and electric and motor transportation, who are already covered.

Statistical publications dealing with prices contain monthly consumer price indexes for: transportation; automobile operation; new passenger cars; gasoline; local transportation; and street car and bus fares. Price indexes for freight rates are a noteworthy omission from the *Prices & Price Indexes* publication.

Also the annual *National Accounts* publication includes information on transport subsidies by the Federal Government, provincial taxes on gasoline and motor vehicles, and on the contribution of transportation and storage to the Gross Domestic Product at factor cost, to corporation profits, and to other national aggregates.

Transportation is also included—in the categories "transportation, storage, and trade" and "transportation equipment" in the input-output table in the Dominion Bureau of Statistics' study of the inter-industry flow of goods and services, 1949. It would be worthwhile to include specific information eventually on transport alone and even individual modes of transport in such input-output studies of the whole economy.

Finally, transportation data are included in a number of publications used by people who are not specialists in transportation at all. General users of statistical information, or specialists in fields other than transport, may often find the degree of detail in the chapter on transportation in the *Canada*

Year Book, 1959, sufficient for their purpose. Material on transport in these publications and in the monthly *Canadian Statistical Review* is usually similar to that available in greater detail and sooner in the specialized transport publications. On the other hand, information in the Dominion Bureau of Statistics *Daily Bulletin* may draw the attention of any user of this service to a specialized publication on transport which has just been issued that day, and give him a summary of the statistics as well. Also, in the May 17, 1960 issue, Dominion Bureau of Statistics published for the first time estimates of intercity ton-miles by each mode of transport, as well as a percentage distribution, with separate series for the years 1938 to 1958 for rail, road, water, air and oil pipeline. While not a specialized publication, the *Daily Bulletin* may from time to time prove useful to any user of transport statistics.

Summary of Coverage in Specialized Transport Periodicals

Enough has been said to indicate the great volume of statistical data published with reference to transportation in a variety of publications. At this point it is desirable to say more about the exact nature of the transport statistics now being published. It will then be possible to work toward more precise recommendations for improvement once the gaps and weaknesses in present statistics are more clearly defined. We will deal specifically only with the specialized publications on transport. That is where improvement must start.

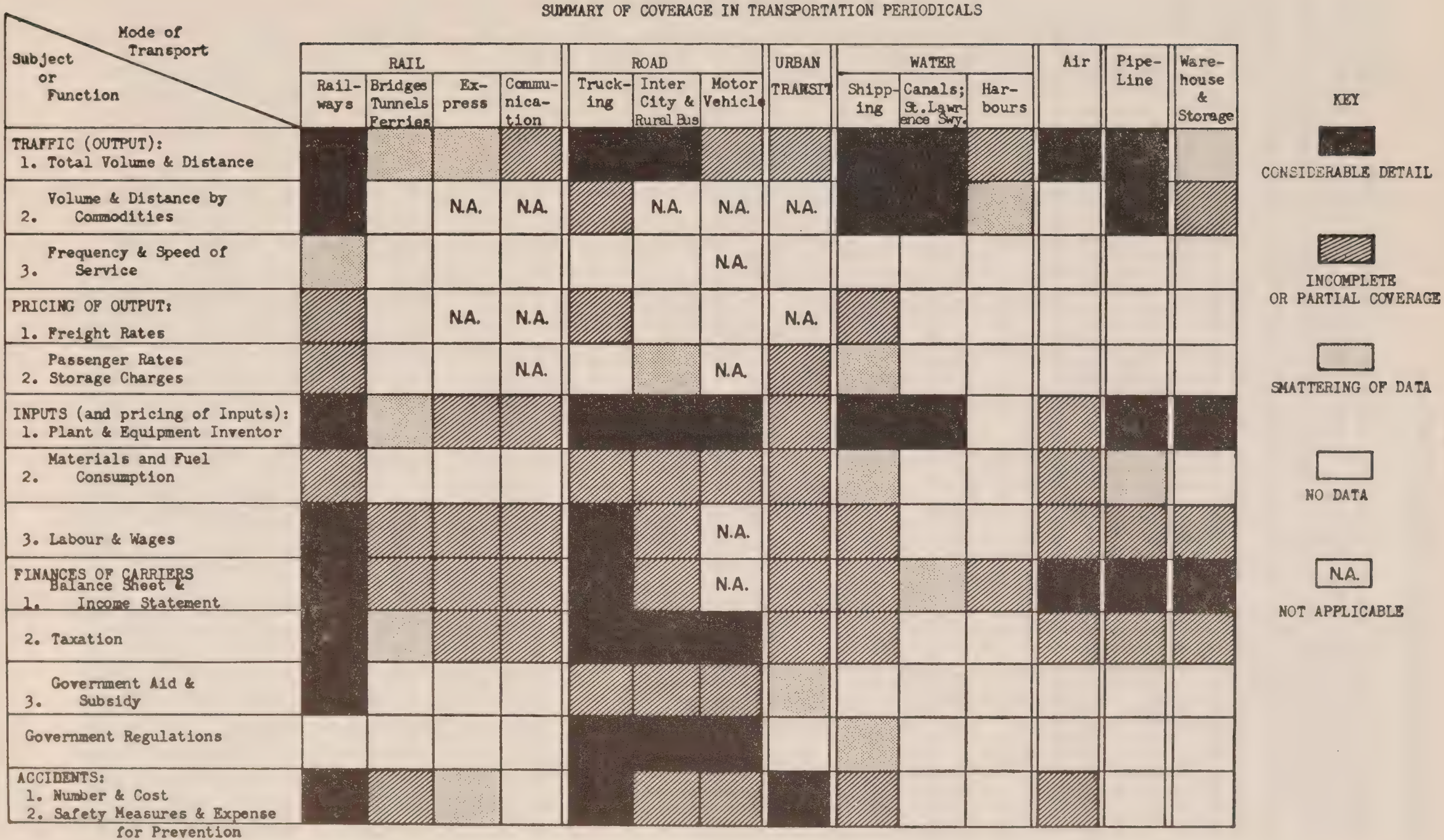
A broad summary of the coverage of the specialized publications on transport (including all the publications described in the Appendix) is presented in Chart 1. Classification of statistical data for use in Chart 1 is (1) by mode of transport and (2) by subject or function with which statistics may deal.[1] The chart shows the extent of coverage—considerable detail; incomplete coverage; smattering of data; or no data at all. Areas in which statistical material is now concentrated become apparent from the chart and it is then possible to appraise the significance of the gaps.

The subjects in the left-hand column of Chart 1 relate to aspects of transport operations and financing concerning which there might be a need for public information. The analysis in Chapter 1 demonstrated a need for statistics dealing with pricing of carriers' outputs—freight rates, passenger fares and storage charges. Replies to questionnaires supported a need for an index of freight rates. Also there was a demand for statistics dealing with the amount of output (traffic) of carriers. The replies to questionnaires

[1] Judgements concerning the extent of coverage in each square in the chart were based on a detailed description of the statistical material available under each subject for each means of transport. This detailed material is not reproduced in this report, but is included in the working papers in the files of the Royal Commission on Transportation.

CHART 1

SUMMARY OF COVERAGE IN TRANSPORTATION PERIODICALS



supported a need for statistics of traffic by commodity and by origin and destination. Statistics measuring economic efficiency in Chart 1 usually fall under the heading of traffic—total volume—because they combine certain cost information (or sometimes carriers' revenue) with measures of output, for example "freight train revenue per train mile". Statistics relating to technical efficiency are not classed separately, but are included in the output or "total volume and distance" category. The classification in Chart 1 is not related explicitly to use but rather to the nature of the subject matter of the statistics. Uses may not always be ascertainable objectively, whereas subject matter of a statistical series is more precisely definable. So the classification emphasizes certain aspects of transport. One aspect is output or traffic (volume, distance, speed) and the commodity data necessary for integrating these with data for other industries. One distinct subject is the pricing of outputs (rates). Another aspect is inputs—the inventory of plant and equipment, materials and fuel, and labour necessary for producing transportation service. Then there is the financial aspect. It may sometimes be difficult to integrate the financial data with input and output data, but they form part of a single piece—the fabric of transport service in Canada. Government regulations and accidents are additional aspects of transport service. Regulations may entail cost, and so may safety measures, and in this way these features of transport service tie into the same piece of material. So the subject classes are broadly related to different uses that may be made of statistics, but subjects and uses, while reconcilable, are not identical. It is not necessary that all of the classes fit together. Each class of statistical material has distinct uses of its own regardless of any need for bringing all series together. A good programme of statistics is concerned with maximum usefulness of the statistics in each class as well as an adequate coverage and co-ordination of all classes of published transport data. The classes in Chart 1 do not cover every subject, nor relate to every use. But they do serve to categorize the statistical series available, and an appraisal of their usefulness readily follows.

We can see from Chart 1 that more detailed statistics are available for rail and truck than for other means of transport. Particularly great detail is provided for rail transport. Even for rail, though, there are gaps. One is the complete absence of information on government regulations though there is much detail on this subject for trucks. A smattering of data is published on frequency and speed of rail service (none on frequency actually). And existing information on freight rates and passenger fares and on materials and fuel consumption is judged to be incomplete or to cover the subject only partially. On trucking, information on traffic by commodities provides only partial coverage, and there is nothing on storage charges of commercial trucking firms or on frequency and speed of service.

Urban transit is only partially covered by current statistics, except where accidents are concerned. Statistical reporting on the minor carriers, live express or ferries and bridges or canals, is spotty. The most noticeable gaps are: (1) nothing on air traffic by commodities; (2) very little on volume of goods stored—most of it is on grain; (3) nothing on air, pipeline, or warehouse rates, while water rate information is confined to grain; (4) nothing at all on government subsidies to water, air, pipeline, warehousing, and only a smattering on subsidies to urban transit; (5) coverage of airline statistics is only partial on a number of subjects—inputs of plant and equipment inventory, materials and fuel consumption, and labour. Gaps in bridges, tunnels and ferries, in express and in railway communications are possibly not of great importance. More data on harbours and canals, however, might be useful.

Judgement of these matters however, must await a more detailed consideration of the contents of the statistical series represented by the squares in Chart 1. The content of each statistical periodical is described separately in a catalogue in the Appendix, illustrated by exhibits. The publications appear in this catalogue according to the type of transport to which they refer—rail, road, urban transit, water, air, pipeline, warehouse and storage, or transportation equipment. In the text of the report, however, we shall follow the order implied in Chart 1. The statistical series, without much detailed reference to the periodical in which they are found, will be classed according to carrier and subject, and the adequacy of statistics in each of these classes will be appraised.

Traffic: Volume, Speed and Distance

The large amount of data published on total volume of traffic for each of the major carriers is indicated by Chart 1. Such statistics relate to volume, distance, and speed or frequency of service. "Tons" and "carloads" measure volume, "average haul" measures distance, "ton-miles" or "car-miles" combine measures of volume and distance. Statistics regarding frequency of service seem to be non-existent, and there are no data at all on the speed of service, except in terms of average speed of railway freight trains (in miles per hour) and "on-time performance" of passenger trains. Since terminal handling can be a time-consuming factor in freight movement, it might be advisable to sample the time between actual loading of freight at origin and actual unloading and destination, or alternatively between making out bill of lading and notification of arrival of freight at destination. Volume, speed and distance are the main aspects of transport output—but special services such as refrigeration, milling-in-transit, assistance in loading and unloading are also part of the transport service. The special service features vary

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markedly from carrier to carrier, and there is little indication of the extent of such services in the published statistics of traffic. Traffic statistics serve a wide variety of uses in measurement of economic efficiency of transport, in forecasting traffic, sales business conditions and in calculating carriers' costs.

Another important feature of traffic statistics is the possibility of analysis by commodity and by region. Without this type of breakdown, it is difficult to relate the data to specific industries or areas of the country. In some ways, each region of the country has its own distinct economic problems which entitle it to be treated as an economic entity. Analysis of many questions of regional economic policy—Dominion-Provincial relations, for example,—demand availability of regional data. And transport is frequently an important issue in regional economic analysis. Significant regional data are available through statistics of traffic, and where there are important omissions in this respect, they will be noted. Gaps in commodity data are of sufficient importance, however, to warrant a separate line for "Traffic by Commodities" in Chart 1. For all major intercity transport, statistics of volume of output are published in considerable detail.

Information on railway carloadings is available four times monthly (*see* App. p. 498-499) with a breakdown for 47 commodities and less than carload traffic. The regional breakdown is very broad—eastern and western divisions of the country—and therefore not particularly useful. There is no corresponding information on truckloadings. Such statistics would be of value because the two together would provide a useful economic barometer, available in print, one would hope, shortly after the close of each period. On a monthly basis, more detail of traffic is available for all carriers, and the greatest detail of all is available annually, though often many months after the close of the year.

For rail traffic, tons of freight appear in the monthly issue of *Railway Freight Traffic,* published by the Dominion Bureau of Statistics. The commodity classification used is that of the Association of American Railroads, and so does not coincide with that used by the Dominion Bureau of Statistics for other statistical series, such as international trade. The same information is available also in the annual issue. Tons originated and terminated are shown (*see* App. p. 499), but there is no link between origin of a shipment and its destination, which greatly limits the usefulness of the series. Additional limitations are the fact that imports by water are not separated from rail shipments originating at Canadian stations, and that exports by water are included with other traffic terminating at Canadian stations. No clear separation of domestic and international shipments is possible. These same limitations apply in the annual publication, *Railway Transport,* Part V: *Freight Carried by Principal Commodity Classes,* which gives similar information for each of 22 Canadian railways.

The annual *Waybill Analysis, Carload All-Rail Traffic,* published by the Board of Transport Commissioners, also utilizes the commodity classification of the Association of American Railroads. But there are more data included than merely tons of freight. Number of carloads, revenue tons, ton-miles, car-miles and average haul are all measures of railway output recorded by commodity in this publication. These data are supplemented by statistics of average revenue per ton-mile, a rough measure of pricing of output, and by information on type of rates (*see* App. p. 506). The regional breakdown is quite broad. Traffic originating and terminating in eastern, western, and maritime regions is shown separately, but again statistical tables suffer from the weakness of no link between origin and destination of shipments. Furthermore, the fact that the basis of the data is a 1 per cent sample of carload waybills renders the data unreliable, particularly in details. The degree of accuracy was, however, sufficient apparently to warrant 6 of 23 respondents to the questionnaire (Table 1) reporting that the publication was useful to them "in detail".

Other limitations of the Waybill Analysis include the omission of traffic over the American border and the omission of less than carload traffic (attempted only once by the Board and then dropped because of the labour involved). Also, the publication gives no indication of mixed-media traffic, such as combined lake and rail movements. It would be particularly helpful to have traffic data which could be related to exports and imports. And availability of mixed-media traffic data (lack of which is one important general criticism of present transport statistics) would assist in the promotion of through routing and co-ordination among all modes of transportation. Appropriate combinations of media can promote economic efficiency in transport.[1]

Nowhere in present traffic statistics is there an analysis of piggyback traffic, (now stated in total without commodity breakdown), fishyback traffic or containerized freight. Statistics relating to joint movements by rail and truck, or rail and water, and specifically relating to these new developments in freight service, would be quite advantageous, as is indicated by the replies to the questionnaire.

In addition to the published tonnage and ton-mile statistics by commodity, there is a variety of other information on rail traffic for which there is no commodity breakdown. Gross ton-miles, car-miles, train-miles, locomotive-miles, passenger-miles, are published in various forms annually and monthly in *Railway Operating Statistics*. Also, the publication contains a variety of averages—measures of revenue per unit of traffic (per freight train-mile or per ton-mile, for example), and measures of operating perform-

[1] A study of American transportation policy by the U.S. Department of Commerce, *Federal Transportation Policy and Program* (March 1960), recommends encouragement of through routes and joint rates between several forms of transport, p. 8.

ance such as average ton-miles per loaded car-mile. Such information is shown separately for the Canadian National Railways, Canadian Pacific Railway, and the total of 22 Canadian railways (*see* App. p. 504). Similar information for each of the 22 railways appears in *Railway Transport,* Parts I and IV (*see* App. p. 499-501 and 502-503). Properly used, many of these averages are indicators of technical efficiency or economic efficiency of railways. Yet the statistics of this type require considerable intelligent interpretation before they can be used for that purpose. More interpretation of the limitations and uses of these statistics might be profitably included in the text at the front of these publications.

Measures of output of other phases of rail operation are contained in separate publications which deal respectively with express, communications, and also with bridges, tunnels and ferries. The express publication tells nothing of importance about the quantity of express traffic—only the value of financial paper issued (*see* App. p. 506-507). Express car-miles in freight and passenger service by type of motive power, and in work train service appear in *Railway Transport,* Part IV (*see* App. p. 502-503), but not in the publication *Express Statistics.* This latter publication could be made more comprehensive by the addition of statistics of volume of express traffic. The statistics of output of telegraph and cable companies are more adequate, containing detail of telegrams sent and received, cablegrams sent and received, and money transfers. Traffic over bridges, through tunnels, and on ferries, with totals for each category is counted in terms of passengers, trucks, buses, motorcycles, and so on.

Traffic by Commodities

The main gap in statistics of truck traffic is the paucity of commodity data. Commodity data are limited to six broad categories—agricultural; animal; mine; forest products; manufactures and miscellaneous; and NOS general freight.

No commodity breakdown is provided for urban trucks. Commodity totals are given by province of registration (Atlantic provinces grouped together), separately for international and interprovincial class, and intra-provincial intercity class of traffic (*see* App. p. 509-511). A much more detailed commodity classification, preferably the Standard Commodity Classification used by the Dominion Bureau of Statistics, would greatly improve the value of the data. The inclusion of a breakdown by commodities for urban truck movements would also be useful. Also traffic flows of each commodity by origin and destination would be valuable information.

The most useful material on truck traffic is included in the annual publication *Motor Transport Traffic,* with seven separate volumes for national

estimates and for provincial (*see* App. p. 509-512). No data are published monthly on truck traffic at all. The other main source of trucking information is an older series, *Motor Carriers—Freight* (*see* App. p. 508-509), which contains financial, traffic, equipment, and other statistics for each of four classes of carrier, depending upon size, with least detail for the smallest firms. The trucking statistics all somehow give an impression of unnecessary complexity. The inclusion of different amounts of data for different classes does not make for quick comprehension of the statistics. In the *Motor Transport Traffic* publication, the numerous classifications of truck according to inter-provincial and international, intra-provincial, intercity, private, for-hire, farm trucks, urban trucks, and vehicle weight groups make each publication a maze to the uninitiated. The fault may be in the presentation, but in any event the statistics are frighteningly complicated at first glance.

Just as the truck statistics are deficient in commodity breakdown, so the air cargo (freight and express) statistics would benefit from an extension in this direction. There are no commodity data at all for air cargo, which is an area of great potential in North America in years to come. A study of air cargo by Boeing Airplane Company predicted that domestic air cargo traffic in the United States would rise from about 470 million ton-miles in 1957 to 2 billion ton-miles in 1965 and over 5 billion in 1970. The trend in world air cargo traffic is similar. Between 1946 and 1957, world air cargo traffic expanded over 20 per cent annually.[1] The time to begin gathering statistical series is not after a marked growth has occurred, but before it occurs. Statistics of air cargo by commodity and origin and destination would be of growing use. Such statistics would be a useful addition to the Dominion Bureau of Statistics publication, *Civil Aviation.*

In regard to water traffic, tons by commodity are now available but not ton-miles. In fact, aggregate estimates of ton-miles by water have only recently become available. The monthly publication, *Shipping Statistics,* shows some commodity tonnages for coastwise shipping and foreign shipping, and the annual *Shipping Report* contains such data in considerable detail (*see* App. p. 522-524). Weaknesses of these data are (1) the fact that in coastwise shipping the amount loaded frequently does not correspond with the amount unloaded; (2) absence of ton-miles, or data linking origin and destination; and (3) the large size of the "general cargo" category. In coastwise traffic, statistics of cargo tons by commodities are contained in the *Traffic Report of the St. Lawrence Seaway,* published annually by Seaway Authority, not Dominion Bureau of Statistics (*see* App. p. 527-529). But the data are only partial in coverage in the sense that only Seaway traffic is included.

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[1] Boeing Airplane Company, *Forecast of Free World Passenger and Cargo Air Traffic (1965-70-75),* p. 18-23 (published 1959).

Except for a great amount of data on grain in storage in elevators, as reported by weekly, monthly, quarterly and annual publications by the Dominion Bureau of Statistics dealing with the grain trade, there is nothing on storage and warehouse by commodities. The *Grain Trade of Canada,* published annually by the Dominion Bureau of Statistics, contains a wealth of detail on movements of the various grains.

Grain products are not the only ones of importance insofar as storage is concerned. The Dominion Bureau of Statistics should take a comprehensive conceptual look at the storage statistics. One result might be separation of particular types of storage, or a linking of storage with particular special industries engaged as well in transportation such as the furniture moving industry. Recently the *Globe and Mail*[1] published an article entitled "Staff moves are becoming costly factor in business". Such an article would gain from the availability of specific data on furniture moving and storage industry.

Passenger Traffic

Up to this point we have been mainly concerned with freight. Gaps also exist in the passenger statistics which are scattered through many different publications. In the rail traffic statistics, much detail is provided on passengers, passenger-miles, passenger train-miles and passenger revenue per passenger train-mile, for each individual railway. In the Dominion Bureau of Statistics publication, *Passenger Bus Statistics,* there are statistics of passengers, miles run by buses and revenue vehicle miles for Group 1, 2 and 3 motor carriers. The traffic is classed according to chartered and regular routes (intercity and rural; urban and suburban). Separate data are published for each province. But in addition to this, data on buses are included in five other Dominion Bureau of Statistics publications.[2] For water passengers, traffic statistics appear in *Canal Statistics* annually and *Summary of Canal Statistics* monthly, as well as in the Traffic Report of the St. Lawrence Seaway (published by the Seaway Authority). *Civil Aviation* contains great detail on travel by air. The Air Transport Board in a publication which is not for general distribution, *Origin and Destination Statistics: Mainline Scheduled Traffic of Revenue Passengers, 1955-1959,* published for September and

[1] August 30, 1960.

[2] *Railway Transport,* Part IV contains motor bus-miles for each of 22 railways; *Motor Carriers—Freight* contains detail of passengers and miles run by buses; *Motor Transport Traffic* contains detail of mileage per bus, average journey, passengers, passenger miles, capacity seat-miles, and so on; *Urban Transit* contains information on revenue passengers carried for urban transit operations of intercity and rural passenger carriers; *Travel Between Canada and the United States* monthly and *Travel Between Canada and Other Countries* annually carry information about travellers crossing the Canadian-American border by bus. Private automobile traffic and trans-border air and rail also are included in two publications dealing with trans-border travel.

March in each of five years the number of passengers by origin and destination between Canadian stations and also between Canadian stations and of terminal points of Trans-Canada Air Lines in the United States (*see* App. p. 533-534).

The passenger statistics create a spotty impression. There is no uniformity in them and the data are sandwiched in a variety of publications. It would be useful to have a more methodical survey by origin and destination of passenger travel by all modes of transportation. Passenger travel is one area in which the failure to co-ordinate statistics by different media of transport is particularly striking.

Recommendations for Traffic Statistics

Not every statistical series or publication relating to transport has been covered up to this stage, though the Appendix is quite comprehensive. Nevertheless, the discussion has gone far enough to indicate some structural weaknesses in the present array of transport statistics. The following are the chief weaknesses, with recommendations pointing the direction of improvement:

1. A general need is for comparable data relating traffic handled by different modes of transport. This need is specially great in a time of keen competition among carriers. Also, where data are deficient for certain modes of transportation, existing statistics should be extended to fill gaps. Railway traffic data are needed on a basis comparable with other carriers on the same commodity classification. This necessitates conversion of present statistics or more likely introduction of a new series using the Standard Commodity Classification rather than the classification of the Association of American Railroads. In the case of trucking, commodity statistics are non-existent for urban trucking, and the commodity classification is not detailed enough for private and "for-hire" interurban trucking. Air commodity statistics do not exist. Water statistics by commodities exist for tons, but not ton-miles. Accuracy of the coastwise statistics for a number of ports is questionable and the canal and St. Lawrence Seaway statistics do not cover all the traffic. These deficiencies should be remedied. One method of doing so is suggested in Chapter 4, "A Canadian Industrial Freight Traffic Survey".

2. In regard to traffic statistics, another need is to link origins and destinations to show as far as possible actual movements of traffic. Care in designing such statistics would be necessary so as to avoid going too far in revealing operations of any particular company

to its competitors. In the water statistics, tonnage data are given by ports but the loadings and unloadings are not sufficiently closely related to each other. Sometimes freight is unloaded in coastal trade which, so far as the statistics show, has never been loaded. Rail traffic reports do not distinguish domestic and foreign goods originating at or destined for Canadian stations. Truck statistics are shown only by province of registry of truck. For all carriers we need proper origin and destination statistics.

3. The small size of sample in the rail carload *Waybill Analysis* is often criticized. But replies to questionnaires do not indicate the small sample really is useless on this account. It is possible to be more critical of some of the omissions: less than carload traffic; mixed-media; piggyback; containerized traffic and trans-border. These omissions should be remedied in the interest of promoting efficient transport by through-routing, and in order to promote comparability of transport with other industrial statistics. Also, better analysis of competition among the different media of transport would be possible with a more comprehensive coverage of traffic. Moreover, the commodity classification used in the *Waybill Analysis* is a railway classification, not comparable with other carriers. Further discussion of the *Waybill Analysis* and traffic statistics follows in Chapter 4.

4. Another omission from present traffic statistics is details of volume of traffic benefiting from special services like refrigeration, carrier assistance in loading and unloading, milling in transit, and so on. Such information might usefully be published on a comparable basis for all carriers.

5. There is a general need to improve traffic analysis through provision of data on traffic, by commodities origin and destination. Statistics of tons, ton-miles, average haul per ton, revenue per ton-mile should be published on this basis. A proposal along these lines is set forth in Chapter 4.

6. Also, in part, because of its potential usefulness as a general economic indicator, it would be worthwhile to supplement the existing rail *Carloadings* report, published four times a month, with a similar report on truck loadings.

7. Data on speed of service are almost entirely missing from government statistics. Train-hours in freight service is about the only time measure appearing in all the government statistics. This information appears in Parts I and IV of *Railway Transport* (*see* App. p. 499-503). There are no statistics at all on frequency of service by any carrier. There is a definite need to develop series of statistics

comparable for different carriers on this subject. Even sample data indicating speed and frequency might well be sufficient.

8. *Express Statistics* should contain measures of express output, so as to make the data comprehensive in this special subject.

9. The categories or the presentation of trucking statistics should be simplified.

10. An explanation of the uses of railway output data and degree to which economic and technical efficiency are measurable by each of them should be included in each issue of the appropriate periodicals.

11. Commodity statistics for storage and warehousing of goods other than grain should be provided.

12. There are many freight traffic publications relating to rail transport. The publication *Railway Transport* appears only after a sizeable delay. The various volumes appeared 8 to 14 months after close of the year 1958. Also it largely duplicates earlier series. Some volumes of it probably could be omitted.

Actual rail freight rate information is confined to data for grain, published in *Grain Trade of Canada* annually. There is nothing published on truck rates, or urban cartage charges, or air rates. Water freight rates on grain from Fort William and Port Arthur to various points on Great Lakes are shown in *Canal Statistics* (*see* App. p. 525-527), and also in *Grain Trade of Canada*. Nothing is published on pipeline rates or warehouse and storage rates.

For road and truck, however, there are statistics of average revenue per ton-mile. Usually revenue per ton-mile is an average of several rates, except where the commodity designation coincides exactly with that used for ratemaking purposes.

In regard to rail, the 1 per cent sample of carload traffic in the Board of Transport Commissioners' *Waybill Analysis* provides a close approximation to rate information because average revenue per ton-mile is published for individual commodities. Revenues per car-mile is also stated, which is a less useful indication of price of service or rate. The information in the *Waybill Analysis* is particularly useful because information about traffic moving on different types of rate is given—class rates, commodity rates, statutory rates, agreed charges, and so on (*see* App. p. 506). Less useful is the average revenue per ton-mile of freight for all traffic for separate railways published in several other publications.[1]

[1] This information appears in monthly and annual issues of *Railway Operating Statistics*, in *Railway Transport*, Parts I and II, in *Canadian National Railways, 1923-1958*, and in *Canadian Pacific Railway Company, 1923-1958*.

For trucking, average revenue per ton-mile appears for "for-hire" trucks only (since private truckers do not levy charges on their own freight). Information is given only for six broad commodity groups and for intercity movements. Also published is information on revenue per truck and revenue per mile travelled. Such statistics are presented in the national and provincial issues of the annual *Motor Transport Traffic* publication.

Existing published information on pricing, even of railway services, is insufficient for production of an index of freight rates. Such an index would be useful for comparison with other price indexes. Also, it would be worthwhile to publish more information on prices charged for specific movements of freight and for rates on traffic by length of haul (by mileage blocks). Pricing information is important in analysis of the transport industry and competition among carriers, and also in relating transport to other phases of industrial processing. A proposal for an index of freight rates, for each carrier, and also for specific commodities is examined in Chapter 3—"An Index of Freight Rates". Chapters 3 and 4 will demonstrate that the provision of more explicit pricing information could be joined with a proposal for more detailed statistics of flows of traffic, by commodity with origin and destination related. Also it would be useful to have some information on storage charges, now non-existent.

Passenger Fares

Urban Transit contains details of passenger fares charged for each of 13 major transit systems. This is the only information relating directly to passenger fares in all the government statistics. There is nothing at all on taxicab fares.

Rail average revenue per passenger mile appears in monthly and annual issues of *Railway Operating Statistics* for each of the Canadian National and the Canadian Pacific and total of 22 Canadian railways (*see* App. p. 504). Also these statistics appear in *Railway Transport,* Part II. The same type of information and also data on average revenue per passenger (as well as per passenger-mile) are published in *Railway Transport,* Part I, and in the publications *Canadian National Railways, 1923-1958,* and *Canadian Pacific Railway Company, 1923-1958.*

For bus traffic, the only figures on average passenger revenues are included in *Motor Transport Traffic*. Revenue per mile, revenue per bus, and revenue per passenger-mile are recorded there for the various provinces, but nothing of this sort is published in *Passenger Bus Statistics.*

A certain amount of additional information can be found in the monthly Dominion Bureau of Statistics publication, *Prices & Price Indexes,*

where there are consumer price index series for transportation as a whole, for automobile operation, new passenger cars, gasoline, local transportation, and street car and bus fares. The pricing of passenger service is not as significant for the economy as freight rates. Nevertheless, it might be useful to bring together material on traffic and pricing of passenger services into one publication where it can be more readily used.

Inventory of Plant and Equipment

So far we have considered the output side of transport service and will now deal with the inputs—plant and equipment, fuel and materials, and labour. Publication of statistics on inputs facilitates analysis of technological changes in transport, and their effect on demand by carriers for products from other industries. Also, information on employment makes it possible to appraise the effects of technological changes and investment in new capital equipment on employment in transport. Data on wages and hours may prove useful in wage negotiations and in outside studies of wage demands.

A substantial amount of detail on plant and equipment is available for road, rail, pipeline, and water carriers, and on warehouse and storage capacity. In regard to plant and equipment, there is not the same possibility or need for standardization among carriers. Each means of transport has its own peculiar items in an inventory of plant and equipment.

In the rail statistics, substantial amounts of detail are published regarding mileage of track, car equipment, motive power, rail and ties, and so on. Capacity and type of equipment are recorded. The main sources of such information are *Railway Transport,* Part III, which deals exclusively with equipment, track, and fuel statistics, and Part I of the same publication which contains "Comparative Summary Statistics" (*see* App. p. 499-501). Part III for the year 1958 appeared (as Table 2 later in the chapter shows) nine months after the close of the year, and Part I, 14 months after the end of 1958. The delay is not as serious a matter as a similar delay in traffic statistics would be, as there is not generally the same need for analysis close after the event.

One apparent weakness in these statistics relates to the need that they should reflect clearly changes in technology. For instance, with dieselization the nature of motive power has changed considerably, and a locomotive now is very different in its capacity to do work. With technical improvements in diesel locomotives, the change could continue. It would be useful, therefore, to publish information about horsepower of diesel units in service. Locomotive-miles, for example, become meaningless if a locomotive is not a standard piece of equipment. It is desirable to search out some factor common to all locomotives (horsepower, for example) and to express capacity and

work done in those terms. Some advances could be made here. Also, it would be useful to have in these publications related material on dollar investment in plant and equipment, for instance in the dieselization programmes of major railways.

Statistics of plant and equipment for bridges, tunnels and ferries consist of a smattering of information on two companies—the Van Buren Bridge Company and the International Bridge and Terminal Company in *Railway Transport,* Part III. If bridges, tunnels and ferries are of any separate significance, it might be useful to have a more adequate description of their plant and equipment in the publication dealing with that subject—*International Bridge, Tunnel and Ferry Companies.* For communications, existing statistics of wire and cable mileage, channel and circuit mileage, and pole line mileage probably suffice. In the publication *Express Statistics* the number of express offices is stated, and details of route mileage are published according to type of carrier—rail, water, air, motor, and miscellaneous (*see* App. p. 506-507). It is useful to have comparable information for the express routes of different modes of transport. Availability of express traffic information on a similar basis would round out the publication. As it is, the publication seems incomplete.

Most of the information on truck equipment, stated by capacity, type, and kind of fuel, is found in *Motor Carriers—Freight* (see App. p. 508-509) with additional information on the truck population by gross vehicle weight group in *Motor Transport Traffic.* Also there is a great deal of information on registrations of taxicabs, buses, trucks and other motor vehicles in the annual publication, *The Motor Vehicle* (*see* App. p. 512). The statistics are given for provinces and for municipalities. *Passenger Bus Statistics* contains detail of bus equipment by region, model year, and seating capacity. *Urban Transit* also contains information on revenue equipment classed by seating capacity (*see* App. p. 520-521). Detail of highway and rural road mileage and of urban street mileage appear in *Road and Street Mileage and Expenditure.* Trucks associated with firms offering public warehousing and storage are reported in the annual publication, *Warehousing.* Related material is scattered through a number of publications, and yet this may be inevitable since each of the publications relates to some distinct aspect of road transport.

For oil pipelines, information is available for each of 32 companies on pipeline mileage separately for gathering and trunk lines, and by pipe diameter. Also there is information on pumping stations on trunk lines by rated horsepower. The statistics are published in the annual issue of *Oil Pipe Line Transport* (*see* App. p. 535-536). No comparable data are available yet for gas pipelines, but the publication *Gas Pipe Line Transport* (monthly only) is of very recent origin and an annual publication is planned which should improve the range of information provided.

Storage capacity is stated in detail for grain elevators, according to the kind of licence, in *Grain Trade of Canada*. For other types of storage, information on net occupiable space in cubic feet according to the kind of storage appears in *Warehousing*.

A very large amount of statistical material appears on the number and registered net tonnage of vessels arriving at and departing from Canadian ports. In the annual *Shipping Report*, such information in great detail is published separately for international seaborne shipping and coastwise shipping. Details of country of registration are also provided (*see* App. p. 522). Some of the same material for ships arriving at and departing from National Harbours Board ports is published in the Board's annual report (*see* App. p. 529-530). Also there are useful statistics in that publication on cargo tonnage inward and outward by foreign ships and by Canadian ships. Such data are useful in analysis of government policy toward the Canadian merchant marine and foreign shipping. From this standpoint, in addition to what is now available, it would also be valuable to have statistics relating specifically to Canadian shipping operators giving the number of ships by type and size which these operators own and the number that they charter.[1]

The publication which is supposed to deal with the Canadian merchant marine is not of much use—*Water Transportation*. Experts in shipping matters declare it is not worth the paper it is written on. The publication contains information on vessels owned or chartered by Canadian marine operators according to type of vessel and location. Foreign carriers are deliberately excluded since the report is designed to measure the Canadian shipping industry only. Yet not all Canadian carriers are included, and the value of this publication is hampered by the lack of an acceptable definition of what comprises the Canadian water transportation industry. Accordingly, it is not possible to use the statistics in this publication to obtain a clear picture of the water transportation industry. The report needs a thorough overhauling and examination from a conceptual standpoint.

Finally, in regard to the plant and equipment of air carriers, information is published in the monthly, preliminary annual, and annual issues of *Civil Aviation* on the average number of aircraft owned and leased by airlines. Data on airport licences in force and on aircraft registered by type appear in the annual issue only. Information on the investment in different types of aircraft might usefully be related to the types of equipment operated by the various carriers. The statistics on plant and equipment of airlines are not as detailed or comprehensive as those published for railway, road or water transport.

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[1] Specifically in regard to type of vessels operating through canals and the St. Lawrence Seaway, there is considerable information published in monthly and annual issues of *Canal Statistics*.

Recommendations for Plant and Equipment Statistics

1. Especially in rail statistics it is important to design statistics of plant and equipment in such a way that technological changes will be evident in the statistics. Capacity of locomotive should be stated in terms of horsepower, and locomotive-miles in the more homogeneous unit of horsepower-miles.

2. In regard to all important carriers—rail, truck, air and shipping—it would be useful to relate equipment inventory explicitly to the dollar investment in it. This type of information would be useful both in analysis of technological change in the industry and of competition among carriers.

3. There should be a more adequate description of the plant and equipment of bridge, tunnel and ferry companies, and it should appear in the publication, *International Bridge, Tunnel and Ferry Companies.*

4. Statistics of pipeline mileage and pumping station capacity should be published for gas pipelines similar to that now available for oil pipelines.

5. To facilitate analysis of problems of the Canadian merchant marine, it would be useful to have statistics of shipping owned and chartered (according to type and size) by all Canadian operators. Provision of such statistics should form part of a conceptual re-examination of the publication, *Water Transportation.*

Materials and Fuel

In the regular periodicals dealing with each mode of transport, there is a considerable amount of information on fuel used by the carriers. Other materials used in operations of carriers are hardly considered at all. Unless there is a demand for such information, however, it does not appear worthwhile to undertake any costly extension of statistics in this direction.

Labour

Earlier in this chapter, reference was made to information on wages, hours, and employees in publications of the Dominion Bureau of Statistics dealing chiefly with labour throughout all industries. Information on average weekly wages and salaries, employment (an index), and number of employees is provided for transportation as a whole, for railways according to such broad categories as maintenance of equipment and maintenance of way, for water transportation, and for truck transportation. Similar data are provided for employment in the production of transportation equipment. This informa-

tion is comparable with that provided for other industries outside the field of transportation. These data on employment in transportation, however, do not relate to individual occupations.

Employees by type of occupation are included, however, in the statistical coverage of the specialized publications dealing with each mode of transport. The number of employees man-hours worked, and earnings by category of employee are reported in the annual oil pipeline periodical. Number of employees and earnings also appear in the annual issue of *Civil Aviation* for airlines, in *Water Transportation* for employees of some Canadian ship operators, and in *Urban Transit* for each of 13 major urban transit systems. Regular and casual employees of warehouse and storage firms are covered in *Warehousing.*

Bus company employees are reported by category of job in *Passenger Bus Statistics* and truck employees in *Motor Carriers—Freight.* General officers, office clerks, drivers, mechanics, working proprietors, and others are separately classified according to the size class of the trucking firm. Information on number of employees and the salaries is published, but not on the total hours worked. Railway employees engaged in highway transport and cartage operations are reported in the sixth volume of *Railway Transport* which deals solely with employment statistics. The number of employees, time on duty, total compensation, and average per hour and per year are recorded—more detail than is published on other employees engaged in trucking.

The amount of material on employment in rail transport is considerably greater and is published mainly in *Railway Transport,* Part VI (*see* App. p. 503-504). For each of 79 categories of employee, information is presented on number of employees, time on duty in hours, average hours worked, total compensation, and average wages and salaries.

Up to the end of 1955, the railways reported to the Dominion Bureau of Statistics details of employment by various groups and the hours *paid for.* Now the railways report the hours *actually worked,* making no allowance for overtime, holidays and vacations. The result is that the wages per hour appear higher than they did on the old basis. As a result, the average wage per hour in this publication for railway employees is not comparable with similar figures in other government publications relating to other industries. Nor can any comparison be made with statistics of average wage per hour for railway workers prior to the end of 1955. Historical continuity has been destroyed. No provision was made for linking the new and old series so that statistics prior to the end of 1955 could be compared with more recent figures. Moreover, the railways also changed the occupational grouping so that historical continuity is completely broken.

Recommendations for Labour Statistics

1. It is recommended that the railways be required to furnish statistics of hours paid for and average compensation per hour paid for on a basis which will permit comparison of present earnings in each occupational category with those prior to the end of 1955. The statistics of earnings of railway employees would then be on a basis comparable with earnings per man-hour in other industries. If it should prove impracticable to revert to the old basis of reporting, the railways should be at least required to provide statistics for a single year (1960 or 1961) on the old as well as the new basis so that historical continuity can be re-established.

2. For truck, water, air and gas pipeline employees, statistics of man-hours paid for should be published, together with averages of earnings per man-hour.

Finances of Carriers

Financial statistics give a picture of the profit or loss position of companies in an industry or branch of industry. Over time, changes in items in an income statement or balance sheet indicate growth, stagnation or decline. Any properly constructed accounting statements will show up whether an industry or a company is doing well or not. Financial information in varying degrees of detail and completeness are published for rail transport, trucks and buses, urban transit, Canadian shipping companies, airlines, pipelines and warehouses.

In amount of detail, the railways are most favoured. *Railway Transport,* Part II, contains only financial statistics, balance sheets, income statements, and statements of capital stock and funded debt for each of about 30 companies. The report for 1958 appeared 13 months after the close of the year. Other publications presented railway financial statements to the public some months earlier but in less detail. Operating revenues and expenses, broken down into main categories, and also net rail operating income appear in the monthly issue of *Railway Operating Statistics* and later in the annual issue. Statements of income and capital accounts for the Canadian National and Canadian Pacific are published in the two publications of the Dominion Bureau of Statistics respectively bearing the names of those railways. In addition, *Railway Transport,* Part I, the summary volume issued more than a year after the close of the period 1958, included information on disposal of net income, investment in road and equipment property, railway capital, and the depreciation and reserves of railways in total (*see* App. p. 499-501).

In spite of the very large amount of financial information published, all of it in accordance with the "Uniform Classification of Accounts for Class I Common Carriers", it is quite difficult to relate the financial picture

to the information on carrier inputs and outputs in any specific way. The financial statistics are prepared according to an accounting classification which is not related to functions or inputs or outputs. Revenues may be classed according to broad categories like "freight" and "passenger", but expenditures are not classed the same way, and could be only through an arbitrary splitting of joint expenses. Even where operations are fairly distinct, like storage, wharves, elevators, telegraph and telephone, the revenue categories for such items frequently do not seem to be comparable with the expenditure categories. And often it is difficult to distinguish what non-rail operations may be included or excluded from a given statement. Also, there does not seem to be anything about hotels at all, though these should be a fairly distinct category both as regards revenues and expenses. It would be hazardous to judge railways' efficiency from the financial statements. It would be absolutely impossible to examine any very specific aspect or location of rail operations using the published financial statistics. Another weakness of the railway financial statistics is the inclusion of obscure and relatively meaningless companies who rate first-class accommodation in these periodicals, like the Napierville Junction Railway Company.

The periodicals which contain information about railways also contain financial data on express and communications—operating revenues and expenses, with varying degrees of breakdown by companies. Bridge, tunnel and ferry companies are included too. *Railway Transport,* Part II, contains the income and total operating expenses of each of three Pullman, tunnel and bridge companies, the capital stock of two bridge companies, and the current assets and liabilities of one bridge company. It is not immediately apparent why some items are omitted for some companies but not for others. Data on capital, investments, taxes, and interest are provided for total ferry companies and for total bridge and tunnel companies in the periodical *International Bridge, Tunnel and Ferry Companies.*

The financial statistics of all carriers, voluminous as they are, are probably more impressive to an accountant than they are to a traffic executive or an economist. The questionnaire to users of statistics (Table 1) indicated a demand for information on "cost to carriers of handling shipments between specific points". Such a demand could not be met at all through the present accounting data on expenditures. This is one of the severe limitations of all of the published financial statistics. They do not carry one very far in analyzing efficiency or any aspect of specific operations.

Trucking company financial statistics, subject to exactly the same limitations as the rail statistics, are published mainly in *Motor Carriers—Freight*. Statements of property account and income are published for each size group of trucking firms. Separate statements are given for the Atlantic region and for each of the other provinces (*see* App. p. 508-509). Similar

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information for buses appears in *Passenger Bus Statistics*. The periodical *Motor Transport Traffic* contains only totals of revenue from different truck movements and gross vehicle weight groups. There is nothing on expenses in this publication at all.

Balance sheets and income statements for 13 major urban transit systems are published in the annual issue of *Urban Transit* and total revenues of Class I carriers are reported in the monthly issue (*see* App. p. 520-521).

Financial statements of certain Canadian shipping operators are shown in total in *Water Transportation,* but the statistics are of little use because they relate neither to the entire Canadian shipping industry nor to the operations of any single company. Apart from these statistics, the only financial data relating to water operations are toll revenues of the St. Lawrence Seaway (published in the Seaway Authority's *Traffic Report of the St. Lawrence Seaway*), also information about the revenues and expenses of railways in their water operations (in *Railway Transport,* Part I), and finally some statistics on capital expended by the Canadian National and Canadian Pacific Railways for steamships—in the two publications relating respectively to these railways.

For airlines, detailed statement of property account, balance sheet, and revenues and expenditures are published annually in *Civil Aviation*. The monthly and preliminary annual editions of this periodical contain statements of revenues and expenses only. Separate statements for each of six or seven major airlines appear in the various *Civil Aviation* publications (*see* App. p. 530-532).

Considerable detail of the financial position of each of 32 oil pipeline companies is set forth in *Oil Pipe Line Transport* each year. In the monthly issues, however, only quarterly operating revenues for each of five companies are published. In the relatively new monthly publication, *Gas Pipe Line Transport,* total operating revenues are stated for each of 16 natural gas transmission companies. When the proposed annual issue of this publication is produced, more extensive detail of the financial situation of natural gas pipeline companies can be expected.

The main source of financial data for warehousing and storage is the annual publication, *Warehousing*. Unlike the rail, air and pipeline statistics, however, the warehousing statistics do not provide statements for any individual company's operations. Details of property account, operating revenue and operating expense are given for the total of 213 firms which offer public warehousing and storage with a breakdown for firms in each province.

Some additional financial information concerning warehousing and storage appears incidentally in other publications. For example, the balance sheets and statements of income and expense of the Port Colborne and Prescott grain elevators appear in the *Annual Report of the National Harbours*

Board. In *Railway Transport,* Part I, operating revenues of the total of all railways, from wharves, grain elevators, rents of buildings, storage of freight, and storage of parcels and baggage, are published. In Part II of the same publication, operating revenues for approximately the same storage items are published for each of 31 railway companies or subsidiary companies. On the expense side, however, operating expenses are reported for the Canadian National and Canadian Pacific only, and for only coal and ore wharves and grain elevators. Since the expenses and revenues do not relate to the same items, it is difficult to draw any conclusions about the relative magnitude of revenues and expenses of storage items. Maybe this situation is inevitable in accounts of minor operations of the railways, but it is still difficult to see what purpose is served by the publication of some of this detail.

Because railway statistics are prepared according to an accounting classification which ensures comparability with the accounts of American railways, the existing published reports are useful in their present form. Also, comparisons among Canadian railways can be drawn from these financial statements. Even so, a lot of needs are not fulfilled by the present financial statements, but tinkering with the present accounting classification would not likely help very much. The elimination of separate accounting statements for some of the smaller railway companies like the St. Lawrence and Adirondack and Roberval and Saguenay would be no great loss, but no great economy either. And only a very complete overhaul of the method of reporting expenditures data would permit analysis of costs of specific rail operations in specific localities. Shippers want to have information about the cost to carriers of handling freight between specific points, and the financial statements yield nothing of this sort. A functional approach rather than a financial approach to accounting would be necessary to obtain this type of material. The basic data would be obtainable from the costing departments of the railways rather than from the accounting departments.

From the standpoint of economic analysis, there are great limitations in the usefulness of the financial reports concerning all of the different modes of transport. The present classifications of accounts do not lend themselves readily to measuring the cost or profitability of particular operations or do not lend themselves readily to the requirements of controlling efficiency of operation. They are intended to reveal the financial position of enterprises and are valuable in that sense. The needs of the transport economist and the industrial traffic officer must be met in another way, not through balance sheets and income statements prepared by accounting departments.

Recommendations for Financial Statistics

1. Publication of railway financial statistics on a basis permitting comparisons with American railways should continue.

2. The need for statistics to measure carriers' costs of specific operations cannot be met through the means of company financial statements.

3. Financial statements of some of the small subsidiary railway companies do not seem to have much potential use. Yet the statements have to be prepared anyway and the cost of publishing them is likely quite small. While the railway statistics seem to include extremely insignificant companies, the statistics for other carriers sometimes omit significant companies. The grouping together of a substantial number of firms in the shipping and warehousing reports limits the usefulness of the financial statements for these industries. This same criticism applies to the *Water Transportation* report which does not include all of the Canadian operators and so does not present a comprehensive picture of the industry. The warehousing firms might usefully be classified according to their type of operation. Also, the addition of more companies in the *Urban Transit* report would help to give a more comprehensive picture of the financial situation of the urban transit industry.

Taxes, Subsidies and Government Regulations

Competition among carriers is bound to raise the question of how much each means of transport (and each company) is subsidized by the various levels of government. Where a given means of transport is subsidized while others are not, the operations of the subsidized carriers tend to expand to a greater extent than they would under a *laissez-faire* policy of government toward the industry. If the subsidized carrier receives some form of capital subsidy, it can expand its investment and lower its depreciation costs. It will then be in a more favourable position than it otherwise would be to attract traffic from its competitors through more extensive service and a lower price of service. If the subsidy takes the form of a subsidized reduction in rates or charges, then more traffic moves by the subsidized carrier than would be the case if there were no subsidy. Wherever there is a subsidy, there is a tendency toward misallocation of resources inasmuch as a boost is given to service which could not otherwise pay its way. (Usually it is the inefficient and costly services which receive subsidies.) There is, therefore, real risk of diverting economic resources to inefficient operations when subsidies are paid. The price of so doing is disguised because the subsidy is paid through the tax rate. While there are many arguments for subsidies to bolster regional economies or to assist Canadian industries to meet foreign competition, it is well to measure and be aware of the element of distortion which a subsidy introduced into the economy.

Accordingly, it is in the public interest to know what the subsidies are and how much they cost. Statistics showing both direct and indirect subsidies by governments to the transport industry should be published in as clear a form as possible. Also, it may be useful in the same connection to have

statistics of the taxes paid by carriers to the government. Often the element of subsidy necessitates a study both of the particular tax burden on a carrier and the special subsidies he receives, because it is at least possible that the special taxes on a carrier (not paid by other carriers) could exceed his special benefits.

Cash subsidies and expenditures on construction, and land grants by the different levels of government to the Canadian Pacific Railway and other companies, now part of that system, are stated in the Dominion Bureau of Statistics' annual periodical, *Canadian Pacific Railway Company, 1923-1958.* Government loans and appropriations, federal contributions to the deficits of the Canadian National, and government subsidies to lines, now part of the Canadian National system, are reported in the similar publications for that railway. Aid to the railways and government guarantees of the bonds of the Canadian National are recorded in *Railway Transport,* Part I (*see* App. p. 499-501). In addition, detail of railway tax accruals by level of government and by type of tax appears in Part II of the same publication. Taxes paid by express, telegraph and cable, and international bridge, tunnel and ferry companies are published in much less detailed form in the periodicals relating to those operations, but there is no information on government subsidies to such companies.

Subsidies for urban street expenditures and for highway and rural road expenditure by level of government are published in *Road and Street Mileage and Expenditure* (*see* App. p. 519). Government revenues from motor truck licences and fees and also taxes on gasoline and other motive fuels, by provinces, are published in *The Motor Vehicle* (*see* App. p. 512). Also, there is information on operating taxes and licences and income tax paid by totals of each of Class I and Class II motor carriers according to province in *Motor Carriers—Freight* (*see* App. p. 508-509). In Passenger *Bus Statistics,* there are comparable data for bus companies.

All of this information does not make it possible, however, to arrive at any very definite conclusions regarding subsidies which may in effect be paid by governments to commercial trucks through heavier and more extensive highway construction necessitated by trucks. The problem is one of separating the expenses of road construction and maintenance required for private automobiles from the expense accounted for by the presence of trucks on the roads. To arrive at a better estimate of the proper allocation of costs, it would be necessary to have better statistics than we now have regarding the amount of commercial and non-commercial traffic on highways, with detail according to the gross weight of commercial vehicles. Such information could be provided through more information on origin and destination of truck movements and a survey of passenger travel by motor vehicle. Better traffic statistics in these forms would assist the study of government subsidiza-

tion of highways, which has aroused intense public interest particularly in the United States.

Government subsidies to air carriers are not reported. To a large extent these subsidies would be indirect. Statements of airport costs relative to user charges to the airlines, and of any other indirect or direct subsidies to airlines would be a useful addition to present statistics. General taxes and income taxes are published separately for different categories of air carrier and for each of six or seven major Canadian airlines. Details of total taxes and any special taxes and licences paid by Canadian airlines would facilitate analysis of the subsidization of air traffic.

Regulations imposed by the government may have a sufficiently important effect upon the economic position of an industry to warrant inclusion in published statistics. This is the case with trucking. The Dominion Bureau of Statistics publishes quite extensive information on size, weight, safety, and licence regulations in each province. Such regulations may limit the capacity of equipment which may be used, or may impose special fees or expenses on the carriers. Regulations affecting trucks and buses are skilfully and clearly published in *The Motor Vehicle: Preliminary Report of Registrations and Size, Weight and Safety Regulations,* and also for trucks only in *Motor Transport Traffic* (see App. p. 509-512 and 513).

But road transport is unique in respect to publication of government regulations affecting the industry. It would be worthwhile to study what material on regulation of railways, airlines and other carriers might be published. The passenger equipment of railways, for example, is designed partly from the standpoint of safety rather than economy, and it might be useful to incorporate in some of the railway transport publications regulations which affect the types of equipment which are permitted to be used.

Recommendations for Statistics on Subsidies and Government Regulations

In conclusion, it is recommended that additional statistics of government subsidies, particularly to road, air and urban transit carriers should be published so that a clear picture of direct and indirect subsidies to transport will be available. Also, it is recommended that a study be made of information which might usefully be published on government regulation of different aspects of transport affecting the economic position of carriers. In order to throw further light on the question of the extent of government subsidies to commercial trucking, it is suggested that this is one function which could be usefully served by statistics showing origin and destination of truck traffic and statistics illustrating the pattern of passenger traffic, particularly by automobile.

Accident Statistics

Statistics on accidents are quite well developed for all carriers. There is a specific publication dealing with road accident—*Motor Vehicle Traffic Accidents,* but otherwise the accident statistics are included in the special reports for different modes of transport. The only suggestion for improvement is that statistics be provided which show (a) the cost of damage to persons and property as a result of different types of accidents, and (b) expenditures by government and private bodies on prevention of specific types of accidents.

Transportation Equipment

In addition to statistical periodicals dealing with each means of transport, the Dominion Bureau of Statistics issues a series of nine publications containing statistics of the manufacture of transportation equipment. The content of these periodicals is described in the Appendix (p. 541-544). The Standard Industrial Classification used by the Dominion Bureau of Statistics provides for a separate transportation equipment group, consisting of a number of sub-industries—aircraft, shipbuilding, bicycles, boat building, motor vehicles, motor vehicle parts, railway rolling stock, and miscellaneous equipment. Statistics on these industries are comparable with those published for other manufacturing industries, and so the manufacture of transportation equipment can easily be compared with other industries in regard to employees and earnings, capital and repair expenditures, inventories, fuel and materials used, and value added by manufacture. This is a very useful series of publications from the standpoint of integrating transport with other industry data.

Timeliness of Published Statistics

Even with increasing mechanization of data processing, the value of useful statistical series is often reduced by delays in publication. The problems in securing the earliest possible publication of statistical series consistent with minimum cost is a challenge to the administrative ability of officials in the Dominion Bureau of Statistics to a greater extent than to the computing equipment.

Table II shows, for each annual publication, the time-lag in production of statistics. To arrive at the time-lag, we compare the month of publication with the period covered in the publication. (On monthly periodicals, the month of publication is not shown.) Many publications appear more than a year after the close of the period covered. Delays of six to nine months in publication are more frequent than lesser delays. The table contains only one

recent example of each periodical, but probably represents fairly accurately the general picture of time-lags in production of transport publications.

It is recommended that the Dominion Bureau of Statistics examine carefully the causes of delay. Various causes are possible. There are delays arising from late reporting by carriers and other members of the public to the Bureau. Then too, the processes of checking, designing the form of statistical tables, of processing, printing, and proof-reading demand an adequate number of experienced employees in the Dominion Bureau of Statistics. Problems of chronic staff shortage and high turn-over in some occupations may be sources of delay in publishing statistics. Also, delay in publication of some statistics may result from the priorities established for different publications over the whole range of government statistics.

The Dominion Bureau of Statistics is undoubtedly aware of the problem of securing prompt publication of statistics, and has made some headway in reducing time-lags. There is room for considerable improvement, however, and it may well be that some of the problems such as the staff shortage will require the attention of other agencies of government dealing with employment and personnel as well as the continuing attention of officials of the Bureau itself. Any effort to solve the problem of earlier availability of transport statistics would pay great dividends in increased usefulness of the statistics.

TABLE 2—TIMELINESS OF TRANSPORT STATISTICS

D.B.S. Number	*Title of publication*	*Current period covered*	*Month of publication*	*Time-lag*	*Price*
	1. RAIL				
52–001	Carloadings	June 1–7, 1960			$3 per year
52–002	Railway Freight Traffic	January 1960	—	—	$2 per year
52–205	Railway Freight Traffic: Year ended December 31, 1958	1958	July 1959	7 months	$1
52–207	Railway Transport 1958, Part I: (Comparative summary statistics 1954 to 1958)	1958	Feb. 1960	14 months	50c.
52–208	Railway Transport 1958, Part II: (Financial statistics)	1958	Jan. 1960	13 months	75c.
52–209	Railway Transport 1958, Part III: (Equipment, track and fuel statistics)	1958	Sept. 1959	9 months	50c.

TABLE 2—TIMELINESS OF TRANSPORT STATISTICS—Continued

D.B.S. Number	*Title of publication*	*Current period covered*	*Month of publication*	*Time-lag*	*Price*
52–210	Railway Transport 1958, Part IV: (Operating and traffic statistics)	1958	Dec. 1959	12 months	50c.
52–211	Railway Transport 1958, Part V: (Freight carried by principal commodity classes)	1958	Nov. 1959	11 months	$1.50
52–212	Railway Transport 1958, Part VI: (Employment statistics)	1958	Aug. 1959	8 months	25c.
52–003	Railway Operating Statistics, March 1960	Financial March 1960 Operating Feb. 1960	—	—	$2 per year
52–206	Railway Operating Statistics, Year 1959	1959	—	—	25c.
52–201	Canadian National Railways, 1923–1958	1958	Aug. 1959	8 months	50c.
52–202	Canadian Pacific Railway Company, 1923–1958	1958	Aug. 1959	8 months	50c.
—	Board of Transport Commissioners for Canada, Waybill Analysis, Carload All-Rail Traffic, 1958	1958	Aug. 1959	8 months	50c.
52–204	Express Statistics	1958	June 1959	6 months	25c.
56–201	Telegraph and Cable Statistics 1958	1958	Sept. 1959	9 months	50c.
53–202	International Bridge, Tunnel and Ferry Companies 1958	1958	June 1959	6 months	50c.
	2. ROAD				
53–205	Motor Carriers—Freight 1957	1957	Sometime in 1959	12+ months	50c.
	Motor Transport Traffic				
53–207	National Estimates	1958	June 1960	18 months	75c.
53–208	Atlantic Provinces	1958	Apr. 1960	16 months	50c.
53–209	Province of Quebec	1958	Feb. 1960	14 months	50c.
53–210	Province of Ontario	1958	Dec. 1959	12 months	50c.
53–211	Province of Manitoba	1958	Dec. 1959	12 months	50c.
53–212	Province of Saskatchewan	1958	Sept. 1959	9 months	50c.
53–213	Province of Alberta	1958	July 1959	7 months	50c.
53–214	Province of British Columbia	1958	Dec. 1959	12 months	50c.

TABLE 2—TIMELINESS OF TRANSPORT STATISTICS—Continued

D.B.S. Number	*Title of publication*	*Current period covered*	*Month of publication*	*Time-lag*	*Price*
53–203	The Motor Vehicle 1958	1958	Feb. 1960	14 months	75c.
53–204	The Motor Vehicle: Preliminary Report of Registrations and Size, Weight and Safety Regulations, 1958	1958	Sept. 1959	9 months	50c.
53–001	Motor Vehicle Traffic Accidents, October–December 1959	October to December 1959	—	—	$2 per year
53–206	Motor Vehicle Traffic Accidents 1958	1958	Sept. 1959	9 months	75c.
53–002	Passenger Bus Statistics	April 1960	—	—	$1 per year
53–215	Passenger Bus Statistics 1958	1958	Mar. 1960	15 months	50c.
66–001	Travel between Canada and the United States, May, 1960	May 1960	—	—	$2 per year; 20c. per copy
66–002	Volume of Highway Traffic entering Canada on Travellers' Vehicle Permits, September, 1959	Sept. 1959	—	—	$1 per year; 10c. per copy
66–201	Travel between Canada and other Countries, 1958	1958	Sept. 1959	9 months	$1
53–201	Road and Street Mileage and Expenditure 1958 (formerly Highway Statistics)	1958	Apr. 1960	16 months	50c.
	3. URBAN TRANSIT				
53–003	Urban Transit, March 1960	Mar. 1960	—	—	$1 per year
53–216	Urban Transit 1958	1958	Nov. 1959	11 months	50c.
53–201	Road and Street Mileage and Expenditure 1958 (formerly Highway Statistics)	1958	Apr. 1960	16 months	50c.
	4. WATER				
54–002	Shipping Statistics February 1960	Feb. 1960	—	—	$2 per year
54–202	Shipping Report 1958, Part I: International Seaborne Shipping	1958	Sept. 1959	9 months	$1.50

TABLE 2—TIMELINESS OF TRANSPORT STATISTICS—Continued

D.B.S. Number	*Title of publication*	*Current period covered*	*Month of publication*	*Time-lag*	*Price*
54–203	Shipping Report 1958, Part II: International Seaborne Shipping	1958	Oct. 1959	10 months	75c.
54–204	Shipping Report 1958, Part III: Coastwise Shipping	1958	Nov. 1959	11 months	75c.
54–205	Water Transportation 1958	1958	Dec. 1959	12 months	50c.
54–001	Summary of Canal Statistics, December 1959	Dec. 1959	—	—	$1 per year
54–201	Canal Statistics 1958	1958	Sept. 1959	9 months	75c.
—	St. Lawrence Seaway Preliminary Toll Traffic Statistics, April 1960	Apr. 1960	May 1960	1 month	—
Catalogue No. TS2–259	Traffic Report of the St. Lawrence Seaway, 1959	1959	—	—	50c.
—	Annual Report of the National Harbours Board, for Calendar Year 1959	1959	Mar. 1960	3 months	25c.
	5. AIR				
51–001	Civil Aviation, December 1959	Dec. 1959	—	—	$2 per year
51–201	Civil Aviation, Preliminary Annual, 1958	1958	June 1959	6 months	50c.
51–202	Civil Aviation, 1958	1958	Nov. 1959	11 months	50c.
—	Air Transport Board: Origin and Destination Statistics: Mainline Scheduled Traffic Survey of Revenue Passengers 1955–1959	1959	May 1960	5 months	—
	6. PIPELINE				
55–001	Oil Pipe Line Transport, April, 1960	Apr. 1960	—	—	$2 per year
55–201	Oil Pipe Line Transport, 1958	1958	Nov. 1959	11 months	50c.
55–002	Gas Pipe Line Transport, May, 1960	May 1960	—	—	$2 per year

TABLE 2—TIMELINESS OF TRANSPORT STATISTICS—Continued

D.B.S. Number	*Title of publication*	*Current period covered*	*Month of publication*	*Time-lag*	*Price*
	7. WAREHOUSE AND STORAGE				
63–212	Warehousing, 1958	1958	Feb. 1960	14 months	50c.
22–004	Grain Statistics Weekly	July 13, 1960	—	—	$3 per year
22–005	The Wheat Review, June, 1960	June 1960	—	—	$3 per year
22–001	Coarse Grains Quarterly, May, 1960	Mar., Apr., May 1960	—	—	$2 per year
22–201	Grain Trade of Canada, 1957–58	Aug. 1, 1957 to July, 31, 1958	Sept. 1959	14 months	$1.50
	8. TRANSPORTATION EQUIPMENT				
42–201	Transportation Equipment 1957 General Review	1957	June 1959	18 months	50c.
42–211	The Railway Rolling Stock Industry, 1958	1958	Oct. 1959	10 months	50c.
42–209	The Motor Vehicles Industry, 1958	1958	Sept. 1959	9 months	50c.
42–210	The Motor Vehicle Parts Industry, 1956	1956	—	—	50c.
42–204	The Bicycle Manufacturing Industry, 1958	1958	Sept. 1959	9 months	25c.
42–206	The Shipbuilding Industry, 1958	1958	Mar. 1960	15 months	25c.
42–205	The Boat Building Industry, 1958	1958	Mar. 1960	15 months	50c.
42–203	The Aircraft and Parts Industry, 1958	1958	Jan. 1960	13 months	50c.
42–212	The Miscellaneous Transportation Equipment Industry, 1958	1958	Nov. 1959	11 months	25c.
42–002	Motor Vehicle Shipments, June, 1960	June 1960	—	—	$1 per year
42–001	Preliminary Report on the Production of Motor Vehicles, June, 1960	June 1960	—	—	$1 per year
63–007	New Motor Vehicle Sales and Motor Vehicle Financing, May, 1960	May 1960	—	—	$1 per year
63–208	New Motor Vehicle Sales and Motor Vehicle Financing, 1958	1958	July 1959	7 months	50c.

A Statistical Programme

Existing transport statistics are definitely used by the public. They are reasonably priced, as the prices listed in Table 2 indicate. Also, one can judge their usefulness partly by their circulation. Even though the various volumes of *Railway Transport* appear from 7 to 14 months after the close of the year, the press run required to fill the demand is around 700 copies. About 450 to 500 copies of the monthly transport periodicals are usually run off. About 1,000 copies of the volume of *Motor Transport Traffic* which contains the national estimates are printed, and 700 for each of the provincial volumes. The circulation of *Motor Carriers—Freight* also is sufficient to warrant printing 700 copies. There is also a substantial demand for the publications dealing with other means of transport. About 900 copies of *Urban Transit* are printed and 750 copies of the annual *Shipping Report*. The press-run of the annual edition of *Civil Aviation* is about 750, and the press-run of the annual *Oil Pipe Line Transport* periodical is 800 and steadily increasing.

Not every publication printed is used. Around 100 subscribers receive every one of the publications but might not use them all. About 75 to 100 copies go to official users, who may or may not use them. There is, however, a substantial body of additional subscribers who have to pay for the publications individually, and so may be presumed to use them now and then if not constantly.

The usefulness of existing transport statistics is corroborated by the replies to the questionnaire summarized in Table 1. Those polled preferred some statistical publications to others, but they were a specialized group of users and the replies reflect this fact. Other users might show a preference for some of the publications which the traffic officers did not favour.

It is not a serious criticism of the Dominion Bureau of Statistics to say that there is room for improvement. The assessment of existing statistics in this chapter has pointed to some weaknesses in the structure of existing statistical publication, and yet officials of the Bureau are as familiar with many of these weaknesses as anyone else. Often it is a matter of the time, staff, and funds necessary for the highly specialized and technical task of designing improved statistical series. Also, there must be a demonstrated need and public demand for improvement. In view of the importance of the transport industry and the importance of a proper analysis of its problem, the Government should extend and improve its statistics in this field. Almost every week the newspapers carry news of some urgent transport problem. The next three chapters, therefore, in the light of the gaps and weaknesses in present statistics in the face of pressing needs, outline a programme for improved Canadian transportation statistics.

Chapter 3

An Index of Freight Rates

Description of an Index

An index of freight rates is a means of measuring changes in the price level of freight service. The level of freight rates in a "base" period is taken as 100 per cent, and the level of rates in some other period is expressed as a percentage of the "base" rates or price level. An index of freight rates, therefore, is like any other price index—the consumer price index or wholesale price index, but the prices to be measured are the prices for transport of freight.

An index of freight rates indicates changes in the price of freight service from month to month, or year to year, depending upon the frequency with which the index is calculated. The index will not show the absolute level of rates, but will tell us by what percentage the level of rates has changed as compared with the base period. Separate indexes can be calculated for different kinds of freight rates. Indexes can be computed on a regional, commodity, or rate-type basis. In fact, an index of freight rates for each of several commodities and regions makes possible a comparison of changing prices of freight service in different industries or parts of the economy. Separate indexes for rail and truck and other types of carrier could give useful information about competition between carriers in pricing of service.

There are several different ways of formulating an index of prices for freight service. A very crude way is to base an index solely on horizontal rate increases granted by the Board of Transport Commissioners for traffic in general. In this form, the index would be 100 in the base year, and if there were a 10 per cent across-the-board increase in freight rates the next year, the index would rise to 110. There is little difficulty in preparing such an index, but it can be quite misleading. A significant amount of traffic is usually excepted from general rate increases—grain moving under statutory rates, and agreed charge traffic being two cases in point. Also new subsidies which lead to lower rates are not easily taken into account in such an index. For these reasons, this form of rate index is too crude for incorporation in statistical publications.

Another concept of a freight rate index is an index based on the average revenue per ton-mile earned by railways from handling freight. The revenue collected per ton-mile amounts to a price charged by the railway for carrying a ton of freight one mile. The ton-mile is only one measure of a railway's output, speed of transit being one other factor in service for which a shipper may be willing to pay. The revenue per ton-mile basis for a price

index gives no recognition to the fact that speed of service, type of handling, or special privileges and service may affect the price charged. The bulkiest commodities exert an influence on the index which may be out of proportion to their total value and importance. With all these disadvantages though, an index which reflects changes in average revenue per ton-mile from year to year still is more accurate than one which is based only on horizontal rate increases. At least average revenue per ton-mile is based on the actual traffic.

If the pattern of traffic shifts from year to year though, the changing composition of traffic may affect the index more than changes in the rates do. For example, a shift toward increased traffic in television sets which earn a high revenue per ton-mile would raise the index of average revenue per ton-mile even though the actual freight rates for television sets and other goods remained unchanged. Therefore, the average revenue per ton-mile reflects not only the freight rates charged, but also the quantity of goods moving under each rate, and the average length of haul (wherever the average revenue per ton-mile is different for long and short hauls).

The same difficulty applies where an index is based simply on average revenue per ton. Unless the average haul is constant, the revenue collected by railways from handling a ton of freight will change depending upon the distance the shipment travels. Again, there will be changes in the index which are not related to changes in the price of service (freight rate).

The difficulty can be overcome by careful "weighting" of the average revenue in every category of traffic according to its importance in tons, and by using the same weights in each year the index is calculated. "Base year weights", which are based on the tonnage moving in each category in a typical year, freeze the traffic pattern used in the index from year to year. Any change in the index number as time goes on will then be the result solely of changes in freight rates.

The index of *Average Freight Rates on Railroad Carload Traffic,* published by the Interstate Commerce Commission in the United States, is calculated in a way which minimizes the influence of changes in traffic as regards commodity, and average haul. The average revenue per hundred-weight (per ton would amount to the same thing) is calculated for each "traffic category" as a first step. The "traffic category" contains traffic which is homogeneous as determined by commodity class, short-line length of haul (mileage block), type of rate, and territorial movement. The average revenue in each traffic category is then weighted by the tonnage shipped in that category in the base period. The weights (for early years of the index) stayed the same for each year that the index was calculated. This assumption that traffic in the base year was typical of the "given" years as well, ensured that any changes in the index arose from price changes and not from other causes.

In more recent years, however, the weighting system was changed to take account of an additional difficulty. The problem is that the pattern of traffic in the base year may soon cease to be typical. The importance of different freight rates may shift as some commodities become more important and others less important in total traffic. If this happens, then an index calculated for, let us say, a given year 1960 on the basis of the traffic pattern in base year 1950 may be unrealistic from the standpoint of what rates are most significant in 1960. The answer to this difficulty was found in the "chain" method of constructing indexes for the given years. From 1951 on, this method has been used by the Interstate Commerce Commission in constructing its index of freight rates.

The "chain" method involves a shift in the weights from year to year to take account of changing traffic patterns. A moving average of tonnage in each traffic category is used as the weight by which the average revenue per ton in the given year is multiplied. This two-year average of the tonnage shipped in each category ensures that the traffic pattern in the given year will affect the index, as well as the traffic pattern in the previous year. When the weighted average revenue per ton has been calculated for, say 1950 and 1951, using the same weight for each year (namely, the average tonnage in each category in those two years), the next step is to calculate average change in rates from 1950 to 1951. So the percentage change in the weighted average revenue per ton is calculated. If we start from 100 per cent in 1950, and this percentage change were 2.0 per cent, then the index for 1951 would be 102.0. The index for 1952 would be calculated from the percentage change in weighted average revenue per ton between 1951 and 1952, "chained" onto the index number 102.0. In the calculation of the change in weighted average revenue per ton from 1951 to 1952, we would use as weights the average of the tonnage in each traffic category in the two years 1951 and 1952.

Through shifting the weights from year to year in this way, we eliminate the problem of calculating the index of freight rates on the basis of a traffic pattern which may be out of date. Yet the method still ensures that the dominant influence on the index numbers from year to year will be changes in the average level of rates and not changes in composition of traffic. Four methods of calculating an index of freight rates have been discussed up to this point—

(1) an index based on general rate increases;

(2) an index based on an unweighted average revenue per ton-mile in each year;

(3) an index based on the average revenue per ton in each homogeneous traffic category with base year tonnage in each category as the weight; and

(4) an index like that produced by the third method but with a moving average of tonnages in each traffic category as the weight.

The fourth, the "chain" method is the best. It copes successfully with the problems of handling exceptions to general rate increases and taking account of changing traffic patterns without allowing the price index to be dominated by factors other than changes in freight rates.

Canadian Experience

A less sophisticated method was used in calculation of an index of freight rates which was published by the Dominion Bureau of Statistics on three occasions in the 1930's. The index was greatly hampered by lack of data which are now fortunately available.

Beginning with the year 1913 and using 1926 as a base year, the Dominion Bureau of Statistics published in 1936 an index of railway freight rates up to 1933. Two years later the index was brought up as far as 1936. Later in the same year (1938), the index was corrected and brought forward to August 1938.

The final index, in tabular and graphic form, together with a table showing the weights used in the index, are reproduced in Chart 2 and Tables 3 and 4. The method used was based not on average revenue per ton as in the present American index, but rather on a selection of actual freight rates for selected hauls and representative commodities. The first step was to prepare a list of commodities representative of the 76 commodity classes for which the railways reported tonnages each year. A total of 48 commodities actually entered into the final index published by the Dominion Bureau of Statistics. It was assumed that this list of commodities was a fair sample of all carload freight carried by the railways. Then selected hauls were chosen representative of the actual movement of each of these commodities. Then freight rates for the selected hauls for these commodities were compiled for a series of years from the tariffs filed with the Board of Railway Commissioners. The rates for the various selected hauls for each commodity were combined by taking the geometric mean of these rates. Then these geometric means, representing the freight rates for each commodity, were in turn combined through the use of weights based on tonnage reported by the railways for these commodities in 1926. Separate indexes were prepared for five commodity groups—agricultural products; animal products; mine products; forest products; and manufactures and miscellaneous. No indexes were prepared for regions or individual commodities. The Canadian index was, therefore, much less detailed than the present American index which gives separate indexes for numerous commodities and also for territorial movements of these commodities.

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The method used in the Canadian index was crude and its authors seemed to recognize its serious limitations. The averaging of selected rates for different hauls of the same commodity by a geometric mean was a particularly haphazard device. And in the introduction to "Index of Railway Freight Rates 1913-1938" the author stated:

> "Unquestionably all hauls should be weighted so that changes in rates for hauls with heavy traffic would have a greater influence on the group index than changes in rates for hauls with light traffic. The difficulty has been to secure data on the volume of traffic moving over the various routes. From the Bureau's reports of production and distribution of grain and coal, however, sufficient data were available to compute fairly satisfactory weights for the principal movements of these commodities, which, in tonnages are by far the most important commodities carried by the railways." (page 2).

The importance of coal and grain in total traffic has steadily declined since the time of this publication. Many of the commodities important in rail traffic today are included in the commodities for which the authors of the Canadian index were unable to find much information on the volume of traffic.

Other criticisms could be levelled at the old Canadian index of freight rates. It is questionable whether the tonnage weights used, based on 1926, were representative of traffic patterns at the two extreme given years of the index—1913 and 1938. The reason for choosing 1926 as the base was evidently that it served as a base year for other indexes computed by the Dominion Bureau of Statistics. This does not mean that it was a typical year for freight traffic throughout the period of the index. The fixed base year weighting was unrealistic in that it did not allow for any changes in composition of freight traffic as time went on.

Furthermore, the process of selecting hauls for each commodity is open to question. If data on the average revenue and average haul for all traffic in a commodity were used, there would be less room for exercise of judgement as to what is representative of actual traffic. The statistics would accordingly be more complete and reliable.

Finally, more precise and numerous commodity classifications than were available in the 1930's would facilitate construction of an accurate index. In broad commodity categories it is difficult to get homogeneous rate characteristics in each category, and factors other than changes in level of rate can affect the index. In the American index there are about 30,000 traffic categories, determined by commodity class, short-line length of haul (mileage block), type of rate, and territorial movement. Data were not available to the authors of the Canadian index which would permit such a careful sorting of traffic according to rate characteristics.

CHART 2

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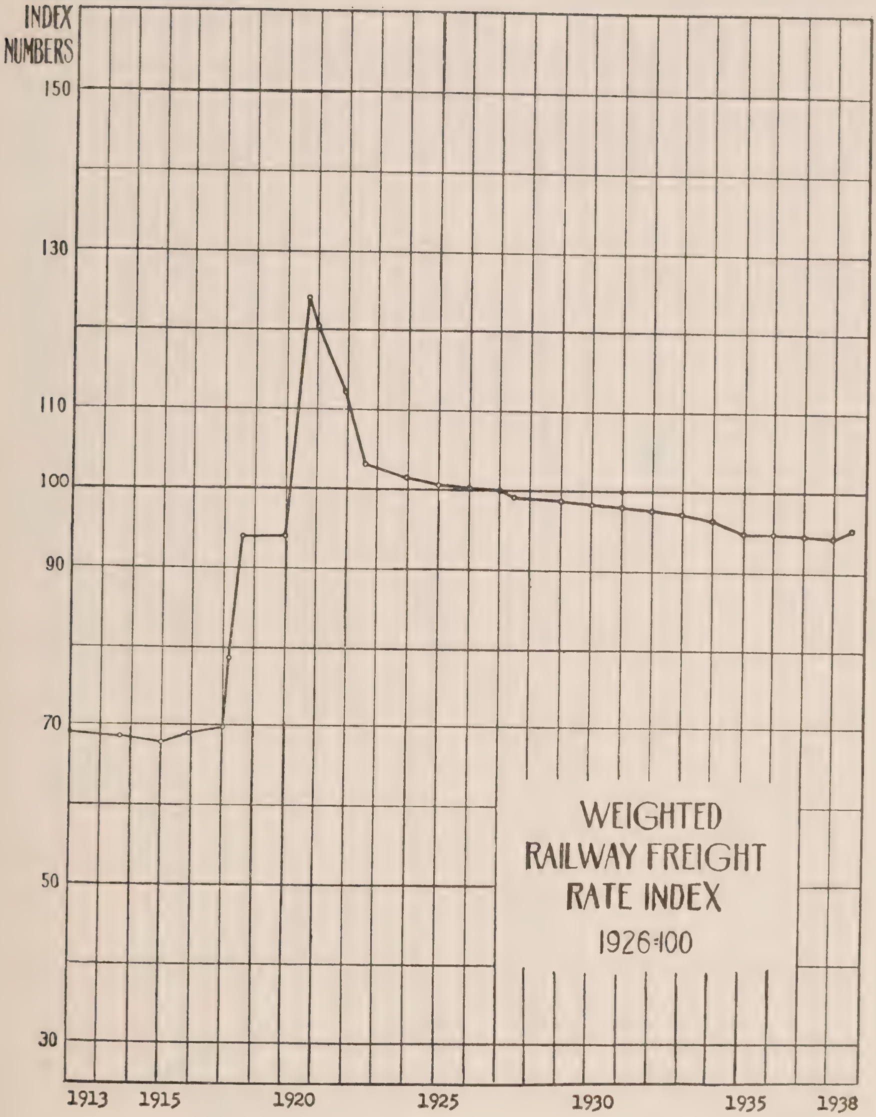

SOURCE: Department of Trade and Commerce, D.B.S. Transportation & Public Utilities Branch, "Index Numbers of Railway Freight Rates 1913 - 1938".

TABLE 3—FREIGHT RATE INDEX NUMBERS
(Revised)
1926 = 100

	Agricultural products	*Animal products*	*Mine products*	*Forest products*	*Manufactures and miscellaneous*	*Total*
Commodities	10	9	9	4	16	48
Rates	112	92	88	49	159	500
Date						
Jan. 1, 1913	84.8	65.7	71.9	65.9	60.4	68.9
[1]Sept. 1, 1914	83.4	65.9	72.7	63.5	60.0	68.4
Dec. 31, 1915	83.4	66.0	69.3	63.5	59.9	67.7
[2]Dec. 1, 1916	84.2	67.6	70.8	64.0	60.8	68.7
Dec. 31, 1917	85.5	68.6	71.4	65.4	61.5	69.6
[3]Mar. 15, 1918	94.3	78.1	81.0	75.3	69.8	78.5
[4]Aug. 12, 1918	110.4	90.3	97.4	86.4	85.9	93.9
Dec. 31, 1919	110.4	90.3	97.4	89.4	85.6	94.0
[5]Sept. 13, 1920	145.3	123.8	114.7	124.5	116.8	124.1
[6]Jan. 1, 1921	143.4	116.8	112.5	117.5	113.1	120.4
[7]Dec. 1, 1921	130.1	106.4	110.4	110.4	104.5	112.1
[8]Aug. 1, 1922	103.0	102.7	103.3	104.2	102.5	103.0
Dec. 31, 1923	101.2	100.3	100.6	101.0	102.6	101.6
Dec. 31, 1924	101.2	100.2	100.6	101.3	100.2	100.6
Dec. 31, 1925	100.1	100.2	100.5	101.3	100.0	100.3
Dec. 31, 1926	100.0	100.0	100.0	100.0	100.0	100.0
[9]July 1, 1927	99.1	100.0	98.7	96.9	99.6	99.1
Dec. 31, 1928	99.1	99.2	98.0	96.9	99.6	98.9
Dec. 31, 1929	98.6	99.2	97.1	96.9	99.0	98.4
Dec. 31, 1930	98.6	99.0	96.0	96.9	99.0	98.1
Dec. 31, 1931	97.3	98.7	96.0	96.9	98.7	97.7
Dec. 31, 1932	97.8	99.6	95.6	96.9	97.3	97.2
Dec. 31, 1933	97.0	99.2	94.9	95.3	96.8	96.5
Dec. 31, 1934	96.2	99.2	93.7	95.3	93.9	94.9
Dec. 31, 1935	95.7	98.2	95.3	94.5	93.8	94.9
Dec. 31, 1936	94.5	98.2	95.5	94.5	93.5	94.6
Dec. 31, 1937	94.9	98.5	95.6	94.9	92.4	94.3
Aug. 1, 1938	96.1	100.0	97.2	94.9	93.2	95.3

[1]Western Rates Case.
[2]Eastern Rates Case.
[3]Fifteen per cent Case.
[4]Twenty-five per cent Case.
[5]Forty per cent Case.
[6]Five per cent Reduction.
[7]Ten per cent Reduction.
[8]General Freight Rate Investigation.
[9]Maritime Freight Rates Act.

SOURCE: Department of Trade and Commerce, DBS Transportation & Public Utilities Branch, "Index Numbers of Railway Freight Rates 1913–1938".

TABLE 4—TABLE OF COMMODITIES AND WEIGHTS USED

Agricultural products		*Animal products*		*Mine products*		*Forest products*		*Manufactures and miscellaneous*	
Wheat	12.65	Horses	0.09	Anthracite Coal	5.26	Logs, Posts, Poles and Piling	1.40	Petroleum Products	2.40
Corn	0.68	Livestock	1.15	Bituminous Coal	13.64	Cordwood and Firewood	2.00	Sugar	0.60
Oats	1.62	Dressed Meats (fresh)	0.46	Lignite Coal	2.50	Pulpwood	3.80	Iron, pig	0.37
Barley	1.17	Dressed Meats, (cured) and other packing house pdts.	0.53	Coke	1.32	Lumber, Timber, Shingles, Box, Crate and Cooperage Material	6.40	Iron and Steel Products	1.47
Rye	0.26	Eggs	0.15	Ores and Concentrates	3.78			Cement	1.10
Flax	0.16	Butter	0.17	Sand and Gravel	4.70			Bricks and Artificial Stone	0.88
Flour	2.21	Cheese	0.11	Stone	1.50			Lime and Plaste	0.40
Hay and Straw	0.88	Wool	0.05	Asphalt	0.23			Sewer Pipe and Drain Tile	0.10
Apples	0.28	Hides and Leather	0.16	Salt	0.34			Agricultural Implements	0.40
Potatoes	0.63							Automobiles	1.68
								Furniture	0.09
								Fertilizers	0.31
								Wood Pulp	1.50
								Newsprint	2.50
								Fish (fresh, frozen and cured)	0.11
								Canned Goods	0.36

SOURCE: Department of Trade and Commerce, DBS Transportation & Public Utilities Branch, "Index Numbers of Railway Freight Rates 1913–1938".

The weaknesses of the Canadian index were recognized at the time to the extent that the preparation of an index of freight rates was discontinued after the third publication on account of the lack of suitable data.

Requirements for a Good Index

If an index is to be satisfactory, the effect of factors other than changes in freight rates must be small as compared with the effect on the index of rate changes. Each "traffic category" (to use the American terminology) must be chosen with care. Traffic within any given category must respond in a similar way to any change in rates. Appropriate data must be available for weighting the relative importance of the different traffic categories so that they can be combined into an index which accurately reflects the importance of different traffic. As far as possible, the index must be based on all rates and all traffic, rather than on a selection of rates deemed to be important. Much more data must be available than were at the disposal of the Dominion Bureau of Statistics for the preparation of its index of freight rates in the 1930's.

Fortunately, much more accurate and detailed information about traffic is now obtainable. The Annual Carload *Waybill Analysis* of the Board of Transport Commissioners is based on a 1 per cent sample of all carload freight traffic moving by rail within Canada. A 1 per cent sample of American carload traffic is used by the Interstate Commerce Commission as the basis for the American index of carload freight rates. Of course, a 1 per cent sample of American traffic contains several times as many carloads as a 1 per cent sample of Canadian traffic, and so a more detailed breakdown according to type of rate, region, and commodity is obtainable in an American index of freight rates. The same breakdown in a Canadian index would be based on such a small number of shipments in many cases that a reliable result would not be obtainable.

Nevertheless, the *Waybill Analysis* of the Board of Transport Commissioners, first published in 1949, would form a basis for an index of freight rates far more accurate than the original Canadian index. The data used to prepare the *Waybill Analysis* have been retained on IBM punch cards since January 1954, and would form the basis for an index of freight rates from that time on.

Looking ahead, one can hardly say, however, that an index based solely on these data would be ideal. One obvious deficiency is that the index would be entirely restricted to railway freight traffic. Truck, airline, water and pipeline freight rates would be excluded. In fact, the limitations are even more severe than that. The *Waybill Analysis* of the Board of Transport Commissioners omits traffic across the American border, less than carload traffic,

and combined rail and water movements of freight. The omission of international traffic is an especially serious limitation. Exports and imports are sufficiently important to the Canadian economy to form an appreciable share of total freight tonnage. All of the limitations of the *Waybill Analysis,* if that were the basis for an index of freight rates, would be carried over into the index itself.

In order to spot further shortcomings of such an index, it is desirable to consider what uses an index of freight rates may have, and what the form of an ideal index would be.

Like other indexes of prices, an index of freight rates would be useful in demonstrating trends in prices. Comparisons between prices of freight service and of other goods and services would be useful to economists and others interested in price levels, inflation, and related matters of government economic policy. Furthermore, comparisons of trends in freight rates and in wholesale and retail prices of particular goods possibly with regard to particular regions of the country, may help to throw light on the extent to which price changes in goods themselves are related to changes in transport costs.

The pricing mechanism is vital in the economy, as the attention governmental regulatory bodies give to prices and pricing practices illustrates. The Dominion Bureau of Statistics prepares information on the prices paid by consumers for children's wear, shoe repairs, cereal products, men's haircuts, newspapers and a variety of other goods and services. In transportation, the only consumer price indexes published are for automobile operation, new passenger cars, gasoline, local transportation, and street car and bus fares. Wholesale price index numbers are published for soap, fertilizer, explosives, carpets, coal, pig iron and over 100 other products, but nothing at all is published in the form of an index of freight rates.

If economical transportation is a goal in a country where transport problems loom large, then information on pricing trends for transportation service is surely as worthy of publication as price indexes of most of the goods and services mentioned, for which a price index is now available.

In the replies of 23 companies or organizations to a questionnaire regarding use made of federal transportation statistics (summarized in Table 1), a substantial number of respondents showed interest in an index of freight rates. The respondents were all people associated with freight traffic in private industry. Of the 23, 13 said they would be interested in having an index of railway freight rates, 13 wanted a similar index for trucking, 7 wanted an index of air freight rates, 11 wanted an index of shipping rates, and 6 expressed interest in an index of pipeline rates. This sample of opinion is not large, but it does show that an interest in an index of freight rates exists, and that it would be used if published.

Just as the wholesale price index and consumer price index are prepared in detail rather than in the form of a single index, so it would be useful to have a breakdown of an index of freight rates. An over-all index tends to conceal different trends in the prices (or freight rates) of specific commodities, or in specific areas. Therefore, along this line of argument and with the American index as a precedent, if a new Canadian index were constructed, it might well be in the form of separate indexes for different commodities in different regions.

In the American publication dealing with rail freight rates, separate indexes are calculated for each of five broad commodity groups, and for more than 60 commodity classifications in which there are approximately 1,000 carloads of freight in the sample. Also there is a separate index for "forwarder traffic", whatever the commodity.

In addition, separate indexes are prepared for each commodity group in 20 regional classifications. Regional classifications are based on movements within and between the five rate territories—Official; Southern; Western Trunk Line; Southwestern; and Mountain-Pacific. Again, unless 1,000 cars or more appear in the sample, a separate index is not published: the sample would not be large enough for reliable results.

Also in the American freight index publication, separate indexes of average freight rates are calculated for interstate rates and for intra-state rates, both by commodity group. All of these indexes apply to rail carload traffic only.

If a Canadian index were to be based on the principle of publishing a separate index only where about 1,000 or more carloads can be used as the basis, the number of indexes would be much fewer than in the Interstate Commerce Commission's publication. The total number of carloads in the 1 per cent sample of traffic used by the Board of Transport Commissioners does not exceed 20,000. In the *Waybill Analysis* based on the sample, only a few commodity classifications contain 1,000 carloads or more—wheat, bituminous coal, gasoline and "manufactures and miscellaneous, n.o.s.". It would not be possible on the basis of the present *Waybill Analysis* to provide a regional breakdown by commodities in an index of rail freight rates.

So far as rail traffic is concerned, if indexes are desired for regional and commodity movements, there is a need for a larger sample of traffic. Either the *Waybill Analysis* of the Board of Transport Commissioners could be expanded, or else some other method of getting traffic data should be used.

The *Waybill Analysis* is not a complete answer to the need for an index of freight rates also because it does not include truck, air, water, or pipeline traffic, or traffic by more than one medium of transport.

As time goes on, a larger sample of railway freight traffic will be facilitated by progress toward completing recording of all waybill informa-

tion on IBM cards. Then a 100 per cent tabulation of tons, revenue, commodity, and origin and destination (giving mileage and regional data) would be readily available for all freight shipments. Where laborious procedures of checking mileages and rates would be excessively costly for 100 per cent of traffic, sample checking should suffice to preserve reasonable accuracy.

Another means of obtaining more comprehensive data for a freight rate index would be through a sampling of traffic reported by shippers rather than by carriers. This device is commonly known as a "census of transportation". The advantage of this approach is that not only rail, but also truck, water, air, pipeline and mixed-media traffic data would be reported. By insistence on uniform reporting, comparability of data for rail and other carriers should be an attainable objective. The absence of revenue data for water carriers, and the absence of reliable information on tons, mileages, and revenues of commodities travelling by truck, make it very difficult to find any existing statistical basis for an index of freight rates for water and truck. Commodity data are not available at all at present for airlines. The "census of transportation" approach would make it possible to fill all the gaps—international rail; truck; water; and airline data which could be used to build indexes of freight rates for these types of traffic. Also, if the sampling were large enough, it should make possible separate indexes for each main region and each important commodity, or commodity group.

For full availability of data for indexes of freight traffic by type of carrier, by commodity, and by region, the sampling of traffic reported by shippers has much to recommend it. The design of an appropriate index is a difficult matter calling for careful attention of experts in sampling and statistics. The actual design of an index will not be attempted here. It is suggested, though, that an index of freight rates be considered with the following breakdown:

1. Separate indexes should be prepared for traffic moving by rail, truck, water, air, and pipelines, and for various combinations of these media of transport where sufficient traffic exists for a reliable index.

2. In addition, for each type of carrier, separate indexes of rates applying on traffic in the main commodity groups would be desirable. There are five of these groups—agriculture; animal products; minerals; forest products; and manufactures. If enough traffic by any medium of transport falls into a general category which cannot be classified by commodity, it might be desirable also to have a separate index for such traffic (as "general cargo" moving by water or "bulk" traffic by air). Less than carload traffic which consists of many small shipments, might be handled as one separate category of traffic not classified by commodity.

Also, where about 1,000 carloads (as a rough criterion) fall within a commodity classification, a separate index would be justified both by the importance of the traffic and the sufficiency of the data. Individual commodities for which a separate index could be calculated would be fairly numerous if indexes were prepared on the basis of information on all traffic rather than from a small sample.

3. Regional indexes should also be constructed for traffic handled by each type of carrier. Regional divisions which might be selected are: Atlantic Provinces; Quebec and Ontario; Prairies and northwestern Ontario; British Columbia and Yukon. International traffic from each of these regions, if sufficiently voluminous, could form the basis of further regional indexes. It would be desirable to separate export from import traffic, and overseas from American traffic. Again, where enough volume falls into a single commodity category or commodity group, further detail would be possible. For example, an index of freight rates might be prepared for grain moving by rail and ocean from the Prairie Provinces overseas. And there would likely be sufficient volume to permit an index of coal moving from the Atlantic Provinces to Central Canada, and another index for coal moving from the United States to Central Canada.

4. Finally, it could be useful to have separate indexes for traffic classified according to mileage blocks, or length of haul.

These specifications relate to an ideal index of freight rates—an over-all index, and also separate indexes in the degree of detail just mentioned. It may be necessary to accept a less ambitious result, or to work toward an index of this kind as availability of data and funds permit. If the *Waybill Analysis* of the Board of Transport Commissioners is used as the basis for an index of freight rates, the degree of detail will be about as limited as that in the original Canadian index published in the 1930's, though the accuracy will be greatly improved. If a "census of transportation" is used, or a 100 per cent sample of railway waybills, then the degree of detail possible will expand accordingly. A 100 per cent sample of railway waybills, obtainable within the next few years as the major railways expand their use of computing devices and record all traffic on punch cards, will permit a detailed picture of freight rates charged by the railways. But it will not solve the problem of getting detailed indexes for other carriers, and it may be a long time before all the major trucking firms keep records in that form. One of the important advantages of a "census of transportation" or sample of traffic reported by shippers would be the availability of a fair amount of detail on traffic by all carriers, including traffic moving by more than one medium, as soon as the sample of traffic was established and yielding results.

An index of freight rates in reasonable detail and of fair accuracy would be useful to transport economists, industrial freight traffic departments, and to others concerned with the pricing of transport service. Such an index need not be strictly comparable with the index published in the United States to be useful in relation to the Canadian economy. The index would gain in usefulness, and its detail could be expanded as time went on without any loss of historical continuity. Because of the deficiencies of the earlier Canadian index, no attempt should be made to link a new index with the old one. It might be best to begin with an index of modest detail for the years 1954 to 1960 using the waybill data collected as a 1 per cent sample of domestic carload rail traffic by the Board of Transport Commissioners. A "census of transportation" would permit more adequate indexes to be started within the next few years for different types of carrier. If this plan were to be followed, the cost of a "census of transportation" would not be chargeable solely to the index of freight rates. The index would be only one statistical product of such a sampling of Canadian freight traffic.

Chapter 4

A Canadian Industrial Freight Traffic Survey and a Review of American Proposals for a Census of Transportation

The U.S. Census of Transportation

In the United States, legislation was passed in 1948 authorizing a "Census of Transportation" to assist in overcoming the inadequacy of transportation data. The Census was to be conducted in 1949 and every fifth year thereafter. No such census has ever been taken, however, because Congress never has authorized the necessary funds. In spite of this fact, the U.S. Department of Commerce still backs strongly the proposed Census of Transportation so as to make available information not obtainable through reporting by the carriers to the Federal Government. Such a census would involve collection of data from shippers, vehicle owners, and private households through the medium of the regular census authority.

The proposal for a Census of Transportation envisages six sets of interrelated surveys. One survey would cover the commodity distribution of freight moved by land, air, and water. Movements of freight would be categorized according to mode of transport, region, market channel (retail, wholesale, interplant), and class of shipper. Initially, general statistics would

be published for two major classes of shippers—manufacturers and agricultural assemblers, with detailed breakdowns for each of twenty representative industry groups. Through this survey, the U.S. Government and public would obtain information on the channels of distribution, markets, and means of transport of products of significant industries. Not only would such information throw new light on the role of transportation in industrial processes, but also it would make possible better forecasting of demand for transportation service. Such forecasts should not only assist industry, but would also make possible more accurate estimates by the carriers and the Government of the cost of transportation service.

Improved Determination of Carriers' Costs

Two recent publications of the U.S. Department of Commerce stress the importance of a Census of Transportation in improving determination of carriers' costs. One publication is entitled *Federal Transportation Policy and Program,* published in March 1960, and the other, *Rationale of Federal Transportation Policy,* is a fuller statement of the justification for the conclusions arrived at in the policy statement. The statement of policy recommends that funds be provided for the Census of Transportation, and points out that one of the numerous benefits will be "an improved basis for forecasting probable traffic volumes, which improves cost estimation because of the relationship between unit costs and demand for transportation service".[1] The explanatory pamphlet links the Census of Transportation to the need, born of an increasingly competitive environment, for improved determination of specific transport costs. The relationship is stated as follows:

> "With the adoption of a marginal cost pricing system, the estimation of future traffic will occupy a place of increasing importance in transportation costing, due to the close relationship between such costs and traffic volume. Since competitive rate actions by all types of carriers are justified only if they increase net income, and as this result is achieved only where response in volume lowers unit costs, accuracy in forecasting volume changes is an essential of meaningful costing for rates relating to the future. Projection of future volume is, however, largely dependent upon the availability of better information as to current geographical and industrial origins, weights, sizes and amounts of traffic, the distances it moves, the rates that move it, and the types of carriers involved. Such information can be comprehensively provided only by a census of transportation . . .".[2]

Improved determination of transport costs is, therefore, in the opinion of the U.S. Department of Commerce, one of the main advantages of the Census of Transportation, and it will result from the survey of commodity

[1] U.S. Department of Commerce, *Federal Transportation Policy and Program,* p. 20.
[2] U.S. Department of Commerce, *Rationale of Federal Transportation Policy,* p. 39.

distribution. Five other sets of surveys are included in the proposal, but since they are less vital to the present study, they will be simply listed at this point and dealt with later. These surveys include a survey of passenger travel by land, air and water, and also surveys of truck and bus inventory and utilization. Air cargo commodity movements constitute another entity for study. And finally, developmental surveys will be undertaken to develop new methods and techniques for taking transportation surveys.

The survey of commodity distribution is, nevertheless, of prime importance, and will be considered here at some length as it is directly related to Canadian experience and needs.

Some of the conditions creating new statistical requirements for the American transportation industry have appeared also in Canada. Increasing competition with other media of transport, particularly trucking, has led Canadian railways to pay increasing attention to determination of transport costs. In the transportation business, each carrier is interested in both his own costs and those of his competitors, and if ratemaking is governed by the cost of service principle, the regulatory authorities become nearly as concerned with costs as the carriers. Improved forecasts of traffic made possible through a survey of commodity movements on a more comprehensive scale than presently exists become important under these competitive conditions in Canada as well as in the United States. The inadequacy of both the *Waybill Analysis* of the Board of Transport Commissioners and the railway freight traffic publications of the Dominion Bureau of Statistics have already been referred to in Chapter 2. And so a Canadian census of transportation would have advantages in facilitating improved cost determination in Canada.

From the standpoint of the public regulatory authorities, the beneficiary of an intensive survey of Canadian freight traffic would not be solely the Board of Transport Commissioners. Air freight rates fall within the jurisdiction of the Air Transport Board, certain rates on grain under the Board of Grain Commissioners, pipeline tolls under the National Energy Board, and seaway tolls under the St. Lawrence Seaway Authority. All authorities responsible for regulation of rates and services would stand to gain from better estimates of traffic flows and demands for transportation service. Consistent decisions of the different regulatory authorities might also be facilitated through an improvement in cost-finding processes.

Other Benefits from a Freight Traffic Survey

Improvement of costing techniques is not the only or necessarily the most important benefit which would result from a Canadian census of transportation. Comprehensive information on the volume of freight by commodity, by carrier, by region, and by industry and type of shipper would be useful in itself to those engaged in market research or solicitation of traffic.

An extremely important benefit would be the availability for the first time of commodity data on a comparable basis for all types of carrier. No data at all are available by commodities for air cargo. Truck traffic is broken down into commodity groups but not into individual commodities. Commodity data for traffic moving by water includes a very large category of "general cargo". The railways' classification of commodities is based on that of the Association of American Railroads and is only roughly comparable with the Standard Classification of Commodities used by the Dominion Bureau of Statistics for other carriers and for its international trade statistics. All of these weaknesses of the present statistics have been dealt with in Chapter 2. All of them would be overcome if a detailed traffic survey obtained information from shippers according to one uniform commodity classification whatever the means of transport utilized. The availability of comparable statistics of traffic for all modes of transport would be an important advantage, making possible better analysis of competition among carriers, and filling significant gaps in present information.

Data would also become available to permit a consistent index of freight rates for all media of transport. It is also likely that other new series would become possible yielding valid comparisons between rail, truck, air, and water carriers.

General economic analysis based on transport data would likewise benefit from the availability of comparable information for all forms of traffic. Rail carloadings, for instance, were once a commonly used indicator of economic activity, but lost much of their significance as traffic was drained away from the railways by competing carriers. A comparable series for carloadings and truckloadings would restore the usefulness of the indicator.

Certain types of traffic that are not now clearly identifiable could be distinguished. A census of transportation would permit a clearer separation of export and import from domestic traffic than now exists (particularly in the case of rail and truck). Traffic moving by more than one medium of transport could be identified and characterized. The true origin and true destination of shipments could be identified and linked one with the other, whereas in present statistics the origins and destinations are not necessarily original or ultimate (as the case may be) and are rarely connected to show the actual haul.

The greater detail of traffic flows would make possible a much better integration of transportation data with industry data. After all, transportation is only one phase in the economic process of production and distribution of goods for sale. Its main significance in the economy is in relation not to itself but to the production of goods. One would accordingly expect that a substantial function of published transportation statistics would be to permit analysis of producers' transport costs and services in relation to other aspects

of the production process—purchase of materials, employment of labour and machines, promotion, distribution and pricing of the product. Here is one important field in which our present statistics fall down. A commodity survey similar to that in the American proposal for a Census of Transportation would meet this need. Not only would industrial users of statistics benefit, but also the prospects for integration of the transport industry into defence mobilization would be greatly improved.

For all these reasons, much more detailed traffic statistics would prove extremely useful. Canadian experience of this type of survey indicates that such surveys would be not only useful but practicable.

Experience with Confidential Survey

The Dominion Bureau of Statistics in July, 1956, began an Industrial Freight Traffic Survey to provide the Board of Transport Commissioners with information needed for equalization of freight rates. The newsprint industry through their association first conducted a detailed traffic survey and then asked the Board of Transport Commissioners to carry out similar surveys for other industries. The Board was given the results of the newsprint survey. The Dominion Bureau of Statistics subsequently surveyed a number of industries, different ones each year, and asked shippers accounting for the bulk of the traffic to keep records of shipments for a month (later one week in each month). Any water shipment over 20,000 pounds was included and any carload shipment by rail or truckload shipment by truck, but small shipments (including any shipments by air) were omitted from the survey. The results of the survey were kept strictly confidential and were never published, but were judged by the Dominion Bureau of Statistics and the Board of Transport Commissioners to be successful. Also, experience was gained in this type of survey.

Statistics from the survey were not put on a yearly basis by the Dominion Bureau of Statistics, nor was any attempt made to obtain continuing reports from each industry from year to year. The Industry Freight Traffic Survey does not, therefore, provide much more than a test run for a continuing survey.

In addition to the Government survey, a private survey of traffic in canned goods yielded usable results, with data comparable for rail and truck carriers.

Support and Objections by Industry

A regular, comprehensive freight traffic survey would meet with both support and objections from private industry. The railways would likely welcome such information, because it would assist in the forecasting of

traffic and provide useful tools for tailoring rates to costs so as to meet competition. Traffic officials in industry would likely also welcome information which facilitated forecasts of future business and trends in the transportation industry. For example, in the questionnaire sent to traffic officials (*see* Table 1), the respondents generally supported the need for publication of statistics which a census of transportation would make available. Of 23 respondents, 12 expressed a desire for statistics of containerized traffic, and 10 wanted statistics of piggyback and fishyback traffic. In other words, these replies indicated support for more information on some of the new trends in traffic. More significant, there was also fair support for the statistics which would mainly result from a census survey: "truck carloading figures similar to rail carloadings already published" (8 out of 23 favoured such data); "volume of traffic by main commodity and origin and destination" by rail (11 in favour), truck (11), air (4) and water (9).

On the other hand, opposition from some shippers would be certain. Some firms customarily protest to the Dominion Bureau of Statistics about the great burden of reporting. In industrial firms, accounting departments which prepare the reports are more likely to protest than traffic departments or market research departments which find more use for the publications of the Dominion Bureau of Statistics. Actually, the burden of reporting should not be excessive if the survey is conducted every five years (as proposed in the United States) or every ten years if it is desired to link the survey with the decennial Census of Canada.

The extent of opposition from business firms will depend in part too on what information is required. There would be much less objection to divulging information about tonnages shipped than there would to be revealing the type of rate applying on shipments or the amount of revenue paid to carriers for transport service. Firms are reluctant to let their competitors know their costs of shipping and might also be reluctant to reveal the information to the Government for inclusion in published statistics.

As far as possible, a comprehensive traffic survey in its published form should be tailored to meet legitimate objections which may be raised. Names of carriers should not be divulged; otherwise certain carriers might reap an unfair competitive advantage at the expense of other carriers.

Design of a Canadian Survey

The design of a regular Canadian survey of industrial freight traffic would be a matter for statistical experts. Experience in Canada and in pilot surveys carried out by the U.S. Department of Commerce in connection with the proposed Census of Transportation indicate that a method of securing satisfactory results is available.

In broad outline, the procedure in a Canadian survey might be as follows. In the first place, it would be necessary to select industries for inclusion in the first survey. In view of the large scope of the undertaking, there is much to be said for choosing industries for the initial survey which are important in the economy, have a fairly high concentration of shipments in a manageably small number of reporting firms, and which ship fairly standard products. Industries with a large number of small firms and a large range of heterogeneous products will be more costly and difficult to survey, and may well be left for inclusion in later surveys when experience has been gained with the survey. There is no need to cover every industry, especially at the start, because results obtained for important industries will be quite useful even if all industries are not covered.

When industries have been selected, a mailing list should be compiled from records kept by the Census Division of the Dominion Bureau of Statistics. Not every firm in an industry must be included in the survey. It should be sufficient to secure reports from firms accounting for a substantial share (70 per cent or more) of shipments of sales in the industry. Firms chosen for inclusion should make available to the Dominion Bureau of Statistics records of shipments in and out of the plant in the form of bills of lading, sales invoices, or other appropriate documents. In a pilot survey conducted by the U.S. Bureau of the Census for the canning and preserving industry in August 1955, the Bureau used portable microfilm equipment to obtain records from the reporting firms. The experiment was a success and it was concluded that use of this equipment "substantially cut costs, reduced reporting effort, and increased the accuracy of results".[1] A similar method might be used in a Canadian survey. One of the main objections to the survey by reporting firms is likely to be the burden of reporting. If the work of recopying documents is handled by the Dominion Bureau of Statistics with the use of microfilm equipment, objections to the reporting burden would not be so significant. The collection of data for the survey should be based on a scientifically designed sampling procedure. The appropriate agencies for design of the sample and collection of the data would appear to be the Sampling Consultation Section and the Transportation Section of the Dominion Bureau of Statistics. In the American Government, statistical processing is organized in such a way that the Bureau of the Census is the appropriate body for conducting the Census of Transportation, but in Canada the Census Division would not necessarily play any special part in the industry traffic survey apart from providing mailing lists of firms in each industry.

The Canadian Industrial Freight Traffic Survey should be conducted every five or ten years, with a small sample survey annually to permit inter-

[1] U.S. Department of Commerce, *Program for a Census of Transportation: A Series of Transportation Surveys,* (August 1956), p. 39.

polation of traffic statistics for each year. If the comprehensive survey were conducted every ten years, it could be linked into the decennial Census of Industry conducted by the Dominion Bureau of Statistics. The advantage would be that total shipments by industries would then be available, and could be used as control or bench marks to provide "blow-up" factors for the expansion of annual sample survey results. Once experience is gained with full surveys every ten years, if the accuracy of the annual estimates in intercensal years proved to be inadequate, it might be desirable to conduct a full survey every *five* years.

The annual *Waybill Analysis* would be useful in preparation of reliable estimates of commodity movements during the intervening or intercensal years. Its value, however, might not be sufficient unless the size of the waybill sample were increased from the present one per cent to three or five per cent, depending upon the amount of detail required for specific commodities.

The entire survey should be based on the Standard Commodity Classification so that results will be comparable for all carriers and also with other statistical series published by the Dominion Bureau of Statistics, such as the international trade statistics. For the survey to have the full value that it should, it is important to solve the technical problem of relating the statistics not only to commodities in the Standard Commodity Classification but also to specific freight rates (and *types* of rates) used by the various carriers.

The data collected from the records of shipping firms should include: the tons and commodity in each shipment, the revenue paid to the carrier, the type of carrier, the class of rate, and the point (or area) of origin and destination. Also, to permit integration of the survey results with other industry data, shipments should be classed according to "into" or "out of" plant and according to market channel (manufacturer, wholesaler, or inter-plant). Also shipments should be classified according to the industry of shipper and consignee—something of an input-output basis. Small shipments should be excluded from the survey in the interests of reducing the burden of collection of data, but air cargo should definitely be sampled. Separate data should be obtained for special types of traffic—piggyback, fishyback, containerized traffic, and freight forwarder traffic. There may be a special problem in identifying the commodities in such traffic, and shippers may be unaware in many cases by what mode of transport their shipments are carried (if they are under contract with a freight forwarder, for instance). In such cases it may be necessary to approach the carriers of freight forwarders for information which will help to identify the commodities and means of transport in such shipments.

Also it would be desirable to categorize separately urban and inter-urban traffic; export and import and domestic traffic; and to obtain informa-

tion on the commodity breakdown in traffic moving by water in the "general cargo" category, by air in the "bulk transportation" category, and in private trucks. For these latter categories of transport, no commodity data are now published.

The cost of an industrial freight traffic survey cannot readily be estimated until its scope is determined and the sampling programme is designed. It would cost more if the survey were conducted for every industry annually than it would if only major industries were covered and complete surveys were taken only every five or ten years. In practice, it is likely that not all industries would be included, or, if they were, that full detail need not be made available for those industries where sampling and accurate reporting prove difficult. Possibly some idea of cost is conveyed by the budget requirement estimated for the American Census of Transportation in 1958. The entire programme for a year in which a comprehensive survey was planned (until Congress failed to appropriate the funds) was estimated to cost $1,200,000. This amount covered all of the six sets of surveys. The budget allotment proposed for the "Commodity Distribution by Land, Air, and Water Transportation" (corresponding to an industrial freight traffic survey) was $500,000. A Canadian survey could certainly be undertaken for less, and the appropriation would be required only once every five or ten years when a full survey was conducted. Annual appropriations for sample surveys to secure data for interpolation between the "census" years would be substantially smaller.

Furthermore, it might prove to be possible to eliminate certain statistical series now prepared by the Government on the basis of reports from the carriers. If the coverage of traffic were sufficiently broad, the *Annual Waybill Analysis of Carload All-Rail Traffic* prepared by the Board of Transport Commissioners might become superfluous. More likely though, the *Waybill Analysis* should be retained as part of the data required annually for making the annual interpolations between full surveys. In the Dominion Bureau of Statistics publications *Railway Freight Traffic* and *Railway Transport,* Part V, however, the data on traffic could definitely be scaled down. The only reason for retaining these publications in modified form would be that the commodity classification used in these publications is comparable to that used by the Association of American Railroads. For this reason some information might still usefully be prepared on the present basis.

The availability of advanced techniques for electronic data-processing and of a film optical sensing device for input to computers ("FOSDIC") has speeded up census tabulation in the United States.[1] These same modern techniques could be applied to process data for a Canadian industrial freight traffic survey within a reasonably short time after the close of the reporting

[1] *See* "Editorial" in *Traffic World,* July 30, 1960, p. 5.

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period. Eventually, monthly data might be published not too long after the end of each month through the medium of such a survey, but the immediate objective should be publication of comprehensive statistics of traffic every five or (more likely) every ten years with less detailed interpolations published annually.

A survey of industrial freight traffic could usefully be patterned on the commodity distribution survey planned for the American Census of Transportation. But it is misleading to label a Canadian survey of this type as a "Census of Transportation". For one thing, the Census Division of the Dominion Bureau of Statistics might have very little part in the proposed survey. Also, such a label could convey the impression that the survey of freight traffic was part of the regular census of population, while there is actually no necessary connection. Finally, the five additional sets of surveys planned as part of the American Census of Transportation need not be linked at all with the Canadian survey of freight traffic. Accordingly, a preferred title for the Canadian survey recommended in this chapter would be "The Canadian Industrial Freight Traffic Survey".

The other surveys to be included as part of the American Census of Transportation will now be considered briefly. While some of the needs which they are intended to meet also exist in Canada, the appropriate statistical method may be different in the two countries.

Air cargo commodity movements, one of the sets of surveys in the American Census, can be sufficiently documented if air cargo is included in the "Canadian Industrial Freight Traffic Survey". Already Dominion Bureau of Statistics collects information on bus and truck equipment, and it is difficult to see any need for starting all over again with another method. Collection of this information from the carriers, as at present, should suffice. Highway statistics and passenger bus statistics may be improved as time goes on, but there is nothing inherently wrong with the present system of reporting and collection of data.

Finally, a survey of "Passenger Travel by Land, Air, and Water Transportation" was to be included in the American Census of Transportation. The need for a comprehensive study of domestic passenger traffic definitely exists in Canada. In fact, this is one of the important recommendations of the next chapter in this report. The methods used in such a survey would be quite different (and the sources of information would be different) from those employed in a survey of freight traffic. Accordingly, the two should not be linked together especially, and consideration of a passenger traffic survey is left for the next chapter.

In conclusion, it is recommended that a "Canadian Industrial Freight Traffic Survey" be instituted immediately to meet the need for information which will: (1) permit better forecasts of traffic and carrier costs, (2) make

possible comparisons of traffic by commodity handled by different modes of transport, and (3) allow better integration of data concerning transportation of a product with data on its manufacture, distribution, and sale. Other benefits would include the filling of serious gaps in commodity statistics for transport by air, water, truck, and certain types of rail freight. A separate index of freight rates for each medium of transport could be compiled, by commodities, on the basis of information about rates, carrier revenues, and volume of traffic yielded by the survey. Finally, the data developed through a Canadian Industrial Freight Traffic Survey would be of great value in any emergency where the economic resources of the nation had to be mobilized for defence. The needs are pressing, the methods are available, and the project is highly recommended.

Chapter 5

A Passenger Traffic Survey and other Proposals

Passenger Traffic Survey

The weakness of present statistics of passenger traffic is one of the important problems which a forward-looking programme of transport statistics should meet. The existing statistics of passenger traffic are not co-ordinated and integrated in one publication, but are spread through a half dozen different periodicals. For some media of transport the coverage is much better than for others. Only for airlines has there been any material published on passenger traffic flows between specific points. More statistics are needed which explicitly relate traffic moving between major points by each carrier and by private vehicles. Our statistics of trans-border travel are much more highly developed than our statistics of domestic passenger travel. One method of remedying these defects and of providing information useful for analysis of a number of important economic problems would be through a Survey of Passenger Traffic.

Such a survey would serve a number of purposes. Competition is keen in passenger traffic, and the railways particularly face disturbing trends in their traffic and cost of providing passenger service. If the railways were able through a better, cheaper service to attract even a fairly small fraction of traffic from travel by private automobile, their financial situation would be definitely improved. Also, with increasingly heavy investment in expensive equipment and with the constant threat of rapid obsolescence through technological changes, the airlines need improved information on patterns of domestic and international passenger travel. The airline companies are not equipped to gather such information themselves. Then too, the tourist industry

generally—hotels, restaurants, and travel bureaus—would stand to gain from more complete data on the extent, pattern, and trends of passenger travel.

In addition, more information on traffic by passenger automobile, in company with more complete data on commercial truck movements between specific points and classed according to vehicle weight group, would improve greatly the possibility of assessing the relative use made of highways and roads by private and by commercial vehicles. Only then is it possible to throw clear light on the controversy over the extent to which commercial trucking pays its share of the cost of road and highway construction and maintenance. If the volume and nature of truck traffic is such as to occasion greater expenditures in respect to roads than can be met through special taxes and licence fees paid by commercial users, then commercial trucking is subsidized by other taxpayers. If the reverse is true, and trucks pay more than their share of highway costs, then commercial trucking is subsidizing private vehicle traffic. Answers to this question are inconclusive at present, and more adequate statistics of passenger and truck traffic would facilitate a more informed approach to this difficult problem. Material which could form the basis for a sound allocation of road costs would be of interest to railways, the trucking industry, and provincial governments who levy the taxes and pay the bills for highway construction and maintenance.

Finally, a Survey of Passenger Traffic could throw useful light on urban economic problems. One of the great problems posed by growth of large metropolitan areas like Toronto and Montreal is traffic congestion. The transport of people as well as goods in a large urban area is a crucial factor in the economy of the municipality. Large unseen costs arise from excessive delays in moving goods and people. Huge expenditures are incurred for improved roads to help move the ever-increasing traffic. Yet at the same time urban transit systems have such difficulty in covering expenses that they have commonly fallen into municipal ownership where their unhealthy state is only partly concealed by exemptions from taxation. Therefore, within the urban areas themselves, particularly the very large ones, more information is needed about the pattern of passenger travel to permit intelligent solutions to the transport problem.

To meet the challenges of urban transport, provincial and municipal governments and the public at large need to know more about passenger commuter traffic by bus and railway and about revenues and expenses of the carriers in providing this type of service. This is one instance in which publication of railways' costs of providing specific service would be in the public interest. Also we should know more about the pattern of travel by private automobile and by mass transit facilities. Each municipality needs special studies of its own peculiar problems, but the availability of comparable statistics of passenger traffic in all the large urban areas in Canada will make

it easier for each community to know where it stands in relation to other cities with similar problems. Whether to spend vast sums on new throughways or to subsidize low fares to urban transit riders or to pay the railways and buslines to provide more commuter service—these are some of the difficult decisions which can be made correctly only if adequate statistics are available. Such statistics can be developed on a comparable basis for all our big cities like Vancouver, Winnipeg, Montreal and Toronto through a passenger traffic survey carried out at the federal level of government.

The Dominion Bureau of Statistics is already planning a survey of passenger automobiles. It is hoped that the survey can be organized in 1961 and conducted in 1962. The present plan is to secure replies from owners of motor vehicles in order to get information on the use made of each automobile in the sample, the average gasoline used, and average mileage. It may also be possible to obtain answers to questions concerning trips over 100 miles in length. The material obtained in this survey would be useful in the allocation of road costs to highway and private vehicle users, and would also provide information on urban transport.

A survey of larger scope, however, would meet a larger need. In addition to data on passenger travel by private automobile, it would be useful to have material on travel by each mode of transport—bus, taxi, aeroplane, train and ship. This comprehensive Survey of Passenger Traffic would then provide comparable statistics of travel by each type of carrier according to the distance travelled and the specific location. If such a survey were conducted every five or ten years, it would then be possible to note changing patterns in passenger travel. The method of conducting the survey would have to be developed by sampling and statistical experts. Usable results could likely be obtained through hotels and motels, through transportation companies themselves, and through polling the passengers and automobile owners. Results obtained solely through questioning individuals about their trips might be weak because the human memory is not always very accurate. On the other hand, many travellers by private automobile will be missed in reporting by motels, hotels, and transportation companies, so that questions directed to the travelling public are nevertheless likely to be the most important means of eliciting information about passenger travel. A combined approach to the public and to carriers, hotels and motels will likely yield the best results.

As in the case of the Canadian Industrial Freight Traffic Survey, the passenger survey should be conducted every ten years to coincide with the decennial Census. Annual statistics could then be derived from sample surveys. If patterns of passenger travel change so quickly that interpolations in intercensal years prove to be not sufficiently accurate, a full survey could then be taken at five-year intervals instead of ten.

The results of the Survey of Passenger Traffic might well be published in a separate publication, or integrated with other passenger traffic data now published by the Dominion Bureau of Statistics. In addition to reporting passenger traffic movements by length of trip, by means of transport, and by geographic location, the publication might also contain information on the hotel and motel industry.

A Survey of Passenger Traffic would meet such a large number of needs in relation to provision of efficient intercity passenger service and effective solutions to urban transport problems, that it is recommended as one of the key proposals in a programme of improved transportation statistics.

A Programme of Transportation Statistics

The chief recommendations for improving upon the present coverage of transport statistics are: (1) a Canadian Industrial Freight Traffic Survey; (2) an Index of Freight Rates; and (3) a Survey of Passenger Traffic. These recommendations form part of a programme. The various aspects of the programme affect each other, and they also affect existing published statistics. For example, the Industrial Freight Traffic Survey will provide information which is necessary for constructing an Index of Freight Rates for the different means of transport. Both the freight and passenger traffic surveys, conducted every five or ten years, will make it possible to improve and extend existing statistical series dealing with traffic. We can expect that the publications, *Railway Freight Traffic, Motor Transport Traffic and* the *Shipping Report* could all be improved as a result of the more precise information on commodity flows by origin and destination available from a Canadian Industrial Freight Traffic Survey. And some existing publications might possibly become redundant as a result of the new statistical series emerging from the new traffic surveys and the Index of Freight Rates.

All of the statistical tables published by the Government on transportation should form parts of a consistent whole. It is therefore important for the Dominion Bureau of Statistics to undertake a conceptual review of all its transport publications. Unless a statistical periodical is reviewed once in a while, it tends to become a matter of habit, and is published even if its usefulness diminishes. A review of the functions performed by each periodical will have greater significance if it takes place within the framework of a concerted effort to make transport statistics serve the needs of the coming decade, not the decades past.

Such a comprehensive review is entirely appropriate in the 1960's, which are likely to be a time of keen competition within the transport industry and also keen competition in world markets in which much of the product of Canadian industry is sold. At such a time efficiency of transport service is important for each carrier and for other industries which must ship their

products to highly competitive foreign markets or meet tough competition from imports. One way of promoting efficient transport service is to publish more information on the traffic and service of each mode of transport. Great improvements are needed in the provision of comparable statistics of traffic with detail by commodities and regional movements for road, rail, air, water, and pipelines. Better statistics are needed on the relationship between carriers' investment and their inventories of plant and equipment. More information is needed on subsidization of transport companies by governments. Also it is important to commence publication of data concerning a variety of transport and storage operations which are assuming the character of distinct industries —trucking of milk, livestock, and automobiles, freight forwarder traffic, and furniture moving. A reappraisal of the transport statistics in publications of the Federal Government should take account of these needs of the 1960's.

Some of the glaring gaps in present transport statistics can be filled by the International Freight Traffic Survey, by the Index of Freight Rates and by the Passenger Traffic Survey. Many existing statistical series can be improved simply by extending the coverage or speeding up publication. Use of material derived from the proposed traffic surveys will make possible in some publications more accurate and meaningful statistics. Other publications may be eliminated. Once a review of this kind has been decided upon, it is primarily the task of expert statisticians to design the improvements and to recommend the form in which new statistical series should appear. The design of methods and form of presentation of statistics is a highly technical procedure which can best be undertaken by the Dominion Bureau of Statistics. To get the programme of improved transportation statistics under way, the Bureau must have the assurance and instruction from the Government that this programme is one of high priority on which time, resources, and money shall be spent. The problems of the transport industry and the urgency of efficient, low-cost transport in our times are so pressing that a high priority is indicated for modernization of our transport statistics.

Recommendations in Detail

In the text of this report, particularly in Chapter 2, there are many detailed recommendations for improvement of our existing transport statistics. These recommendations relate to gaps or weaknesses in our statistics of traffic, pricing of transport services, employment and earnings, investments in plant and equipment, government subsidies, and financial reports of carriers. It is recommended that the Dominion Bureau of Statistics examine the reason for an average time-lag of over six months after the close of the year in publication of annual transport statistics. All of these recommendations point to deficiencies or directions where improvement is needed.

The urgent need for improvement does not imply any criticism of the Transportation Section of the Dominion Bureau of Statistics whose officials are well aware of the advances which could be made if staff and funds were provided. The recommendation of prime importance in this report is that these officials be given both the instructions and the means to institute a programme of modernization of the transport statistics. A review of existing statistics and design for improvements would cost very little. The programme itself would cost more, depending upon the scope and methods used, but the public benefits would be many-sided and large.

Responsibility for Publication

If a programme of statistics for publication is to be properly conceived and co-ordinated, it must be under one single authority. Because of the statutory authority assigned in this field to the Dominion Bureau of Statistics, it must be the responsibility of this agency of government. As a practical matter too, the Dominion Bureau of Statistics is the only agency which is in a position to develop a broad and consistent programme covering transportation and relating it to statistics of other industries and international trade.

The primary responsibility of the Dominion Bureau of Statistics in the field of statistical publication does not rule out the need for other government departments and boards to develop their own statistics for internal use. The administrative requirements of the Department of Transport, for example, require the processing of statistical material by the Department's own staff and with its own computer equipment. Also, the Board of Transport Commissioners, the Air Transport Board, the National Harbours Board, and certain other government agencies as well must develop transport statistics to suit their own requirements. The questionnaire sent to industrial traffic officials revealed that most of the companies polled had devised their own transport statistics for internal use. Major railways in Canada, including the government-owned Canadian National, prepare statistics for inclusion in their annual reports, along with financial statements. And various government departments and boards present statistical tabulations in their annual reports. All of this activity is entirely reasonable and in the public interest.

When it comes to the publication of periodicals dealing with transport statistics, however, the responsibility should be assumed entirely by the Dominion Bureau of Statistics and by no other agency of government. The annual *Waybill Analysis: All-Rail Carload Traffic* should accordingly be published by the Dominion Bureau of Statistics even if the Board of Transport Commissioners continues to compile the data and have it processed by computers belonging to the Department of Transport. The power to decide upon publication of this information in periodical form should rest with the

Dominion Bureau of Statistics. Unless this authority rests with the Bureau, there will be a tendency for other departments and boards to publish the statistics which they have developed initially for their own use, and then to duplicate or supersede the publications of the Dominion Bureau of Statistics in certain fields. The final result will be a proliferation of statistical agencies with varying degrees of statistical competence, and great difficulty in ensuring a consistent, comparable, and continuous body of statistical information. The Dominion Bureau of Statistics may not always be able to attract as many first-class technical experts in the field of transport as it needs, but co-operation between technical boards and departments and the Bureau should overcome this difficulty. Therefore, it should be the task of the Dominion Bureau of Statistics with such consultation as it considers necessary with other departments to develop as soon as possible a Programme of Transportation Statistics to meet the needs of the 1960's and future decades.

Catalogue of Statistical Series Published in Federal Government Periodicals Relating to Transport (1960)

The statistical content of every periodical published by the Federal Government relating to transportation is described in this Appendix. Also, the agency of the Government which is responsible for preparing the material for the publication is mentioned in each case. Since price of a publication may influence the extent of its use, this too is mentioned. In most cases, judged by standards of private publications, the price is low considering the length and content. Most of these publications are produced by the Dominion Bureau of Statistics, but important periodicals also stem from the Board of Transport Commissioners for Canada and other agencies of the Government.

The publications are classed according to the medium of transport with which each mainly deals. The following are the classes:

Rail;
Road;
Urban transit;
Water;
Air;
Pipeline;
Warehouse and storage;
Transport equipment.

Each description of statistical content of a periodical is related to some specific recent issue. Content may vary somewhat from issue to issue, and reference is made to a definite date of publication in the interests of precision. Since emphasis in this Appendix is on the *kind* of data published rather than on the time period covered by a given statistical series, however, the precise month and year to which series relate have been omitted.

1. RAIL

Carloadings, June 7, 1960

DBS 52-001. Four times a month. Price: $3.00 per year.

This publication contains statistics of number of cars loaded:
— 47 commodities and l.c.l.;
— also total piggyback and cars from connections;
— eastern and western divisions;

One issue each month includes a monthly summary of cars and tonnage loaded and index.
3 pages; 3 tables.

Prepared in Transportation Section of the Public Finance and Transportation Division of the Dominion Bureau of Statistics.

Railway Freight Traffic

DBS 52-002. Monthly. Price: $2.00 per year.

DBS 52-205. Annual. Price: $1.00

Data are classified according to the Freight Commodity Statistics Classification of Association of American Railroads (used in Canada as of January 1, 1957).

Statistics are published of the tons of freight carried by total of 22 Class I and II Railways in Canada.

1. Annual issue shows for each commodity:
   - — tons originated or loaded (including imports at lake or ocean ports);
   - — tons received from U.S. rail and destined to Canada; or destined to U.S.;
   - — tons terminated or unloaded (including exports at lake or ocean ports);
   - — tons delivered to U.S. rail connections.

Separately for Canada, for each province, for Atlantic Provinces and for four Western Provinces.

2. Monthly issue shows for each commodity:
   - — same data for Canada as annual issue;
   - — for each province tons loaded and tons unloaded only.

   January 1960 issue contains 3 tables; 17 pages.
   1958 issue: 13 tables and 2 summary tables; 85 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Railway Transport 1958 Part I (Comparative Summary Statistics 1954 to 1958)

DBS 52-207. Annual. Price: 50¢.

1. CNR railway bonds guaranteed, year ended December 31, 1958, (detail).
2. Aid (Land Grants in Acres) granted to each of six railways (by level of government), 1942 to 1958.

3. Land Grants, cumulative total at December 31, 1958, by each government—bonus grants and grants for right of way, etc.—total to all railways.
4. For total Canadian railways (number unspecified) each year, 1954 to 1958:
   - —aid to railways—cumulative total $ to Dec. 31, by level of government;
   - —first main track mileage, by provinces and U.S.; also by gauge. Second main; industrial; yard track and sidings; mileage;
   - —investments ($) in road and equipment property, year ended Dec. 31—separately in road, equipment, general, undistributed (CNR; CPR; others);
   - —railway capital—stock; debenture stock; funded debt;
   - —depreciation and reserves of railways—road and rolling stock; other properties; operating and deferred maintenance; insurance and casualty; investment; other;
   - —income account: Total railway operating revenues, expenses, tax accruals, other income and expenses and disposal of net income, (detail of operating revenues and expenses);
   - —operating statistics: Locomotive-miles (steam and diesel and other) in freight; passenger; train switching; yard switching; work train service; train-miles-freight; passenger (locomotive and motor unit car); car-miles-freight (loaded; empty; caboose; etc.). Also passenger by type of car separately for locomotive and motor unit car);

     Averages per mile of road; etc.;

     Tons; ton-miles; gross ton-miles; train hours; average haul per ton; etc.;

     Passengers; passenger miles; average passenger per car; average distance per passenger; etc.;

     Average revenue statistics:
   - —taxes, each province and by type of federal tax;
   - —tons carload freight by commodities; l.c.l. tons;
   - —freight cars in service (number and capacity) by type of car;
   - —passenger cars (by type);
   - —locomotives in service (coal; oil; and diesel electric by type);
   - —fuel consumed by locomotives (freight; passenger; etc.) and rail motor cars (by type)—tons and cost. Other fuel consumption;
   - —rails laid (detail);
   - —switch and bridge ties placed in track (detail);
   - —cross-ties purchased; placed in track (detail);

— Accidents;
Persons (by category) injured in train and non-train accidents and dying after 24 hours;
Time lost by employees through injuries (detail);
Accidents resulting from movement of trains (by cause);
Persons (by category) killed and injured in train and non-train accidents, by cause; by class of victim;
Highway crossing accidents (by type of protection at crossing);
— highway crossings (rural and urban) by type of protection, for each province.
34 tables; 31 pages.

Prepared in Transportation Section of the Public Finance Division.

Railway Transport 1958 Part II (Financial Statistics)
DBS 52-208. Annual. Price: 75¢.

Data are classified according to the "Uniform Classification of Accounts for Class I Common Carriers by Railway" (September 1955 issue—prescribed for CNR and CPR effective Jan. 1, 1956, and for all other roads Jan. 1, 1957).

1. Operating revenues and expenses:
   — for each of 31 railway company items including U.S. lines in Canada and CNR in Canada and U.S.;
   — detail of operating revenues—transportation—railway line; incidental;
   — detail of operating expenses with greater detail for CNR and CPR;
   — revenue per ton-mile of freight; revenue per passenger mile;
   — total operating revenues and expenses—joint facility, express, communications, and highway transport (rail).
2. Other income:
   — detail for each of 32 railway company items.
3. Income and total operating expenses of each of 3 pullman, tunnel and bridge companies. Capital stock, funded debt, and detail of current assets and current liabilities of Van Buren Bridge Co.
4. Railway tax accruals:
   — detail for each of 29 railways, by province or country.
5. Capital stock, funded debt, for 33 companies, also subsidiaries.
   Detail of current assets and current liabilities for 24 companies.
   9 tables; 51 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Railway Transport 1958 Part III (Equipment, Track and Fuel Statistics)

DBS 52-209. Annual. Price: 50¢.

1. For each of 27 to 30 railway companies:
   - — number of cars and aggregate capacity in freight passenger, and company service by type;
   - — number of motor vehicles;
   - — number of units motive power and tractive power, by type of locomotive;
   - — mileage (total and route miles) of first main track; second main track; industrial; yard tracks and sidings;
   - — first main track mileage by provinces and territories and U.S.
2. CNR—changes in first main track mileage by provinces and states.
3. For total railways (number unspecified):
   - — railway track mileage under construction at December 31;
   - — rails laid (new and relay), tons and cost, by weight of rail;
   - — fuel (coal, diesel, oil, fuel oil, gasoline) consumed by locomotives (in freight, passenger, switching, work service) and by rail motor cars;
   - — amounts of Canadian and imported fuel (tons and gallons) delivered to fueling stations in each province, Yukon, and U.S.

   8 tables; 13 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Railway Transport 1958 Part IV (Operating and Traffic Statistics)

DBS 52-210. Annual. Price: 50¢.

For *each* of 22 Class I and II Railways in Canada:

1. Passenger:
   - — number of revenue passengers;
   - — passenger miles;
   - — gross ton-miles;
   - — car-miles by type of motive power and type of passenger car; caboose car-miles.
2. Freight:
   - — tons, revenue; non-revenue;
   - — ton-miles-revenue; non-revenue;
   - — gross ton-miles;
   - — train-hours;
   - — car-miles by type of motive power, loaded and empty; caboose car-miles.

3. Freight, passenger and caboose *car-miles* in work train service;
   Train-miles; by freight, passenger and work train service by type of motive power;
   Locomotive-miles—exclusive of switching, by freight, passenger, and work train service;
   Locomotive-miles; train switching and yard switching.
4. Express;
   Car-miles in freight and passenger trains by type of motive power;
   Express car-miles in work train service.
5. Motor bus-miles and motor truck-miles.
   6 tables; 29 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Railway Transport 1958 Part V (Freight Carried by Principal Commodity Classes)

DBS 52-211. Annual. Price: $1.50.

Data are classified according to the Freight Commodity Statistics Classification of Association of American Railroads.

Tons of freight carried by *each* of 22 Class I and II Railways in Canada:

— tons originated—loaded at points in Canada (including imports at lake or ocean ports);
— received from U.S. rail connections;
— tons terminated—unloaded at points in Canada (including exports at lake or ocean ports);
— delivered to U.S. rail connections;
— also *carloads* loaded at points in Canada.

Separately for each commodity and railway.
2 tables; 148 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Railway Transport 1958 Part VI (Employment Statistics)

DBS 52-212. Annual. Price: 25¢.

Data are classified according to the Canadian Classification of Railway Employees and their Compensation.

1. Separately for CNR, CPR, total 19 Class II Railways:

For each of 79 categories of employee, and for communications, express, cartage, highway transport (rail) and outside operations:

— number of employees (monthly average);

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— time on duty (hours);
— total compensation;
— average hours worked;
— average salaries and wages per hour and per year.

2. For total Class III and IV Railways, and for all Railways:
   — for 4 groups of employees (falling into 79 categories not shown separately, and for communications, etc.);
   — also for pullman and international bridge company;
   — number of employees and other data same as (1).
   6 tables; 14 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Railway Operating Statistics

DBS 52-003. Monthly. Price: $2.00 per year.

DBS 52-206. Annual. Price: 25¢.

1. Financial:
   — total operating revenues and expenses and net rail operating income for 22 Class I and II Canadian Railways. Breakdown into main categories of revenue and expense given for *total* 22 railways, CNR and CPR.

2. Operating Statistics:
   For total of 22 railways, CNR and CPR:
   — miles of road operated;
   — freight traffic—tons (revenue freight); ton-miles (revenue and non-revenue);
   — passenger traffic—passengers and passenger miles;
   — gross ton-miles—freight and passenger;
   — train-miles—freight, passenger and work service;
   — car-miles—freight, loaded and empty; passenger;
   — number of employees—railway;
   — pay-roll—railway total and amount chargeable to railway operating expenses;
   — averages per day per mile of road;
   — averages per freight train-miles;
   — miscellaneous averages.
   } Derived from financial and operating data
   March 1960 issue contains 5 tables; 7 pages.
   1959 issue: 5 tables; 6 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Canadian National Railways 1923-1958

DBS 52-201. Annual. Price: 50¢.

Canadian Pacific Railway Company 1923-1958

DBS 52-202. Annual. Price: 50¢.

"Uniform Classification of Accounts for Class I Common Carriers by Railway" (adopted Jan. 1, 1956). CNR and CPR accounts stated on bases as nearly similar as possible (*see* CPR 1923-1958, p. 8-9).

1. For each railway (in its respective publication):
   Each year 1923-1958:
   - income account; total operating revenues and expenses (in CNR separated for Canadian and U.S. lines): fixed charges; net income;
   - capital account; receipts and expenditures (detail);
   - operating statistics:
     - miles of road;
     - revenue freight tons; ton-miles;
     - revenue passengers carried; passenger miles;
     - freight, passenger, and passenger train revenue;
     - freight and passenger train-miles;
     - averages per mile of road operated;
     - averages per freight train-mile and passenger train-miles;
     - average ton-miles per loaded car-mile;
     - average haul; average passenger journey;
     - average revenue—per ton, passenger, ton-mile and passenger mile;
     - employees and pay-roll;
     - operating ratio.
2. For CPR:
   - mileage and capital of leased railways, 1958;
   - cash subsidies and land grants (detail), to 1958;
   - securities outstanding each year 1922 to 1958;
   - dividends, each year 1923 to 1958.
3. For CNR:
   - Government loans and appropriations each year 1923 to 1958.

DBS 52-201. CNR—5 tables; 22 pages.

DBS 52-202. CPR—6 main tables; 19 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

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Board of Transport Commissioners for Canada
Waybill Analysis: Carload All-rail Traffic 1958

Price: 50¢.

1 per cent sample of domestic Canadian carload freight traffic, showing:
— number of carloads;
— revenue;
— weight (tons);
— ton-miles;
— average revenue per ton-mile;
— average haul per ton;
— car-miles;
— average revenue per car-mile.

Classified:

1. By type of rate:
   — class, commodity, multiple rates and mixed shipments at carload rates; U.S. related rates (official);
   — competitive, non-competitive, statutory, agreed charge.

Separately for traffic originating in each region (Maritime; Eastern; Western) and destined to each region (Tables 1-A, 1-B, 1-C).

2. By commodity—Freight Commodity Statistics Classification of the Association of American Railroads:
   — all traffic (Table 2);
   — separately for traffic originating in each region and destined to each region (Table 3).

6 tables; 39 pages.

Prepared by Economics and Accounting Branch, Board of Transport Commissioners.

Express Statistics, 1958

DBS 52-204. Annual. Price: 25¢.

For each of 5 express companies:

1. Financial:
   — operating revenues (detail);
   — operating expenses (detail);
   — capital stock (detail);

— investments in real property; equipment; miscellaneous physical property; other;
— tax accruals by provinces and territories. Federal Government and other.

2. Value of financial paper issued (by type).
3. Equipment—road and platform vehicles (by type) and road vehicles used in cartage services (by type).
4. Employees—number and salaries—full-time and part-time; commissions.
5. Express offices.
6. Route mileage by type of carrier and province, territory, U.S. or ocean-going.
7. Accidents—persons injured; killed.
   1 table; 7 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Telegraph and Cable Statistics, 1958

DBS 56-201. Annual. Price: 50¢.

For each of 10 companies:

1. Cost of property and equipment.
2. Revenues accrued in Canada (detail); other income;
   Expenses (detail);
   Taxes—income and other.
3. Telegrams sent; received (detail);
   Cablegrams sent; received (detail).
4. Money transfers by country of origin and destination.
5. Wire and cable mileage (detail);
   Channel and circuit mileage (detail);
   Pole line mileage (detail);
   Number of offices.
6. Employees—number; salaries; commissions.

Also: Messages handled by Marine radio stations of Department of Transport, by province.
7 tables; 15 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

International Bridge, Tunnel and Ferry Companies, 1958

DBS 53-202. Annual. Price: 50¢.

Separate totals for ferry companies; bridge and tunnel companies:

1. Operating revenues (detail);
   Operating expenses (detail).
2. Investments; capital; taxes; interest.
3. Employees (by type); number of full-time and part-time; salaries.
4. Traffic (passengers; trucks; buses; motorcycles, etc.).
5. Accidents:
   — number of persons (by category) killed and number injured.

   10 tables; 11 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

2. ROAD

Motor Carriers—Freight, 1957

DBS 53-205. Annual. Price: 50¢.

Separately for total Group I carriers (largest); Group II; Group III; Group IV (smallest) by provinces (Atlantic Provinces total):

1. Number reporting:
   — property account;
     — total cost of property, vehicles, etc.;
     —accrued depreciation reserve;
   — operating revenues (freight and other); (greatest detail in case of Groups I and II; less for III, still less for IV);
   — operating expenses;
     — maintenance; wages; fuel; insurance; depreciation; taxes; rents; bridge, tunnel and ferry tolls (greatest detail for Groups I and II; less for III and IV);
   — income taxes;
   — other income.
2. Traffic statistics (Groups I, II, III only):
   — tons freight;
   — fuel by type;
   — separately for intercity and rural; city:
   passengers—regular routes, also charter; miles run by buses—regular routes, also charter.

3. Employees:
   — Group IV only; employees (number; salaries) and working proprietors (number; allowances);
   — separately for Groups I, II, III:
   Number employees and salaries for general officers; office clerks; drivers and helpers; mechanics—maintenance; other. Also working proprietors (number and allowances).
4. Revenue equipment (number)—Groups I, II, III only:
   — trucks (by capacity); road tractors; semi-trailers (by capacity); trailers (by capacity); buses (by capacity);
   — vehicles with diesel engines (trucks; road tractors; buses);
   — vehicles with liquefied petroleum engines.
5. Accidents (total of Groups I, II, III):
   — number of persons killed and number injured—by type of person;
   — number of accidents resulting in property damage over $100;
   — total property damage ($).
   9 tables; 17 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Motor Transport Traffic, 1958

Price: National Estimates—75¢; others—50¢ each.

DBS 53-207: National Estimates,

DBS 53-208: Atlantic Provinces,

DBS 53-209: Province of Quebec,

DBS 53-210: Province of Ontario,

DBS 53-211: Province of Manitoba,

DBS 53-212: Province of Saskatchewan,

DBS 53-213: Province of Alberta,

DBS 53-214: Province of British Columbia.

One publication of estimates for all Canada; 7 separate publications of data for trucks registered in each province.

National Estimates

Graphs:

Truck registrations by type of operation; } Also in each provincial
Net ton-miles by type of operation; } publication

—tons carried by type of operation (each province);

— intercity traffic by commodity group—tons of goods carried.

Statistical Tables:

Truck traffic by Canadian registered trucks.

1. By gross vehicle weight, total Canada only.
   Separately for total truck traffic (for-hire; private intercity); intra-provincial intercity traffic (for-hire; private intercity); total international and interprovincial (for-hire; private intercity):
   — also by 6 commodity groups (agricultural; animal; mine; forest; manufactures and miscellaneous; n.o.s. general freight).
   Separately for intra-provincial intercity traffic (for-hire; private intercity);
   Total interprovincial and international (for-hire; private intercity).

   For total Canada, the following statistics are given:
   — tons (weight of goods);
   — total miles travelled with load;
   — total net ton-miles;
   — average weight carried;
   — average distance per ton;
   — total revenue } for-hire only
   — revenue per ton-mile } for-hire only
   —average annual population.

2. For Total *All* trucks by gross vehicle weight group, Total Canada:
   — also separately for: for-hire trucks; private intercity; private urban; farm trucks—by each province.

   The following statistics are given:
   (a) Mileage—Total; Average yearly mileage per truck; Average haul per ton; per cent of mileage empty.
   (b) Fuel—Gallons and miles per gallon gasoline; diesel oil; other.
   (c) Tons—Total; Average weight (=Ton-miles÷Miles travelled with load);
   Net ton-miles—Total; Average per truck;
   Capacity ton-miles (= Actual miles travelled × estimated capacity or heaviest load, whichever larger)—Total; Average per truck; per cent of Capacity utilized;
   Gross ton-miles—Total; Average per truck.
   (d) Average annual population.

3. For "for-hire" only, by each province:
   — Revenue—Total; Revenue per ton-mile; Revenue per mile travelled; Average revenue per truck.

4. For Total international and interprovincial traffic only:
   — Tons goods carried by province of origin and destination (for-hire; private intercity).
5. Average truck population in Canada, by gross vehicle weight.
   By each province:
   — separately for "for-hire"; private intercity; urban; farm.
6. Survey response, by each province.
   Number of trucks selected in samples; number of questionnaires returned, etc. Separately by "for-hire"; private intercity; urban; farm:
   —reliability of statistics—sampling variability; range (detail);
   — copy of questionnaire.
7. Description of vehicle classifications by type of truck.
   Licence regulations in each province.

Atlantic Provinces

Same statistics and detail, where applicable, separately for total trucks registered in Atlantic Provinces; Trucks registered in Newfoundland; Prince Edward Island; New Brunswick; Nova Scotia.

No data on traffic by commodities for these *individual* provinces though. Data for Total Atlantic Provinces only.

Other Provinces

Same statistics and detail, where applicable, for trucks registered in each province. Data on traffic by commodities for each individual province are included.

Passenger Buses

These data are included in the following publications only:

Ontario;
Manitoba;
Saskatchewan;
Alberta;
British Columbia.

For buses registered in the province:

By passenger seating capacity, separately for traffic performed by buses inside and outside the province; traffic within the province.

1. Mileage—Total; Average yearly mileage per bus; Average distance per passenger.
2. Fuel—Gallons and miles per gallon-gasoline; diesel oil; other.
3. Passengers; Passenger miles; Average number of passengers carried per mile.

4. Capacity seat miles; per cent of capacity utilized.
5. Revenue ($)—Total passenger revenue; Revenue per mile, Revenue per passenger mile; Revenue per bus.

National Estimates .... — 17 tables; 27 pages; 4 graphs;
Atlantic Provinces .... — 19 tables; 18 pages; 2 graphs;
Province of Quebec .... — 11 tables; 12 pages; 2 graphs;
Province of Ontario .... — 13 tables; 13 pages; 2 graphs;
Province of Manitoba .... — 13 tables; 13 pages; 2 graphs;
Province of Saskatchewan .... — 13 tables; 13 pages; 2 graphs;
Province of Alberta .... — 13 tables; 14 pages; 2 graphs;
Province of British Columbia .... — 13 tables; 13 pages; 2 graphs.

Prepared in Transportation Section of Public Finance and Transportation Division.

The Motor Vehicle, 1958

DBS 53-203. Annual. Price: 75¢.

For each province:

1. Registrations of motor vehicles:
   — motor vehicle licences—passenger; motor trucks; taxicabs; buses; motorcycles; trailers (detail);
   — other licences (drivers'; dealers'; gasoline outlets; garage licences).
2. Average population per motor vehicle;
   Average population per passenger car;
   Average number of passenger cars per family.
3. Motor vehicle registrations by municipalities. Separately for passenger; commercial.
4. Provincial revenues from motor vehicle registrations and gasoline tax (detail by type of fee, tax, or licence).
5. Taxes on gasoline and other fuel. Regulations (detail by provinces).
6. Gasoline sales ($)—Gross, Net (tables and graph);
   By months;
   Net sales of diesel oil.
7. State of unsatisfied judgement funds in each province.
8. Regulations. Summary of reciprocal highway agreements for trucking, September 1959.
   14 tables; 3 graphs; 33 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

The Motor Vehicle; Preliminary Report of Registrations and Size, Weight and Safety Regulations, 1958

DBS 53-204. Annual. Price: 50¢.

For each province:

1. Registrations of motor vehicles:
   - — motor vehicle licences—passenger-motor trucks; taxicabs; buses; motorcycles; trailers (detail);
   - — other licences (drivers'; dealers'; gasoline outlets; garage licences).

   Also: Average population per motor vehicle;
   Average population per passenger car;
   Average number of passenger cars per family.

   (Exactly same data as in DBS 53-203, Annual, *The Motor Vehicle, 1958,* but published earlier with unrevised figures.)
2. Size and weight regulations for commercial vehicles in effect March 31, 1959; (detail).
3. Safety regulations for commercial vehicles in effect March 31, 1959; (detail).

   3 tables; 13 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Motor Vehicle Traffic Accidents

DBS 53-001. Quarterly. Price: $2.00 per year.

DBS 53-206. Annual. Price: 75¢.

By each province and Total Yukon and Northwest Territories:

1. Number of accidents (Fatal; injury—total and number resulting in property damage over $100);
   Persons killed, injured (detail).
   Accident ratios—per million vehicle miles based on estimated consumption of petroleum fuels on public roads.
2. Number of accidents:
   - — by class; (detail of: type of accident; month; day; hour of occurrence; road location; road surface; road condition; type of road; weather condition; place of occurrence (rural; urban, etc.); by pedestrian action; by condition of pedestrian.
3. Number of victims, by age groups; (detail of class of victim; sex; month of occurrence; place; type of accident).

4. Number of pedestrians killed and injured; — by condition of pedestrian; — by action of pedestrian. } Annual only.
5. Number of vehicles:
   — by class of accident;
   — by type of vehicle; (detail for condition of vehicle; model year of vehicle; direction of travel of vehicle).
6. Number of drivers:
   — by class of accident; (detail by sex; residence; condition of driver; by driving experience; by driver action; by age group).
7. Intersection accidents—number of victims: — by class of victim; — by road location; (detail by hour; day of occurrence). } Annual only.

   Issue of 1958: 7 tables; 59 pages.

   Issue of October—December 1959: 5 tables; 31 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Passenger Bus Statistics

DBS 53-002. Monthly. Price: $1.00 per year.

DBS 53-215. Annual. Price: 50¢.

Monthly: Intercity and rural Class I carriers only:
by each province and interprovincial:
— number of firms reporting;
— revenue passengers—regular; charter;
— revenue vehicle miles—regular; charter;
— fuel consumed—gallons gasoline; diesel oil;
— total revenue ($).

Annual: Seperate totals for Group I, II, III Motor Carriers by provinces (Atlantic: Total only):
1. Number reporting.
2. Property account—cost of property, vehicles, etc. (detail for Group I only); accrued depreciation reserve.
3. Operating revenues:
   — passenger revenues—regular and extra service, separately for intercity and rural; urban and suburban. Also chartered service (including school);
   — total mail, baggage, express, newspapers, etc.;
   — other.

4. Operating expenses, by type (more detail for Group I)—including operating taxes and licences;
   — other income; } Group I only.
   — income taxes; }
5. Traffic statistics:
   — passengers carried; } separately for chartered and regular routes
   — revenue vehicle miles; } (intercity and rural; urban and suburban).
   — fuel consumed—gallons gasoline; diesel oil.
6. Employees, by type:
   Average number employed; salaries.
7. Revenue equipment: number:
   — gasoline and diesel separately, by model year;
   — by seating capacity.
8. Taxes (by type, excluding income tax).
9. Accidents:
   — number of persons (by type) killed and injured;
   — number fatal; injury accidents;
   — number of accidents resulting in property damage over $100.
   10 tables; 17 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Travel Between Canada and the United States, May 1960

DBS 66-001. Monthly. Price: 20¢ per copy; $2.00 per year.

1. Highway traffic at Canadian border—number of vehicles:
   — by ports, by provinces and Yukon; also vehicles transported by boat direct from U.S.—total only;
   — separately for foreign vehicles (breakdown for: length of stay 24 hours or less; over 24 hours; repeats and taxis; commercial vehicles); and Canadian vehicles (length of stay abroad 24 hours or less; over 24 hours; commercial vehicles).
2. Travellers entering Canada from United States:
   — by provinces and Yukon;
   — separately for rail; bus; boat; plane;
   — separately for Canadian travellers; foreign travellers.
   6 tables, 11 pages.

Prepared in International Trade Division: Balance of Payments Section.

Volume of Highway Traffic Entering Canada on Travellers' Vehicle Permits, September 1959

DBS 66-002. Monthly. Price: 10¢ per copy; $1.00 per year.

"With this issue this publication is being temporarily discontinued because of the effects of a change in the procedure of the Department of National Revenue in dealing with the entry of non-resident vehicles. Publication is expected to be resumed when a new form of presentation is developed for showing comparable monthly statistics of traffic."

Data given are:

Number of vehicles entering Canada on travellers' vehicle permits:
— by province of entry and Yukon.

1 table; 1 page.

Prepared in International Trade Division: Balance of Payments Section.

Travel Between Canada and Other Countries, 1958

DBS 66-201. Annual. Price: $1.00.

A. Contains a 70-page article entitled "Leading Developments in Travel between Canada and Other Countries". Analyses characteristics of traffic crossing the Canadian-American border. The article contains 33 tables, copies of 11 questionnaires given to travellers sampled, and also 3 charts and 2 maps.

Principal data in these statistical tables:

1. Number and expenditures of U.S. travellers in Canada:
   — by auto (non-permit; customs permits; repeat trips); rail; boat; through bus; plane; other.
2. Average declared expenditure per car of non-resident motorists travelling in Canada on customs permits:
   — by class of permit (commuter; summer resident; local; other);
   — by province of exit.
3. Number of non-resident one- and two-day autos travelling on customs permits in transit between selected border points in Ontario.
4. Selected routes of non-resident automobiles (detail).
5. Minimum interprovincial travel by non-resident automobiles (detail).
6. Purpose of visit reported by U.S. motorists visiting Canada (detail). Same data for Canadians returning from U.S.

7. Accommodation used by motorists from U.S.; hotel or resort; motor court or motel; etc. (detail).
8. Average mileage in Canada reported by motorists from U.S. by province of entry and province of destination, special survey, 1958.
9. Expenditures of Canadian travellers in U.S., by type of transportation used to re-enter Canada:
   — auto; train; boat; bus (exclusive of local bus); aeroplane; other.
10. Number of non-immigrant visitors entering Canada direct from overseas; by aeroplane; by vessel:
    — by country of residence.
11. Residents of Canada returning direct from overseas by chief ports of re-entry (detail).
12. Purpose of visit reported by Canadians returning direct from overseas (%):
    — by aeroplane; by vessel.

B. Additional statistical tables contain the following data:

1. Non-resident motorists travelling on customs permits who departed from Canada in 1958; also separately for Canadian automobiles returning to Canada in 1958:

   By days' stay:

   — number of permits (or cars);
   — per cent of total permits (or cars);
   — average expenditure per car ($);
   — estimated total expenditures ($);
   — per cent of total expenditures for all visits;
   — number of car-days;
   — average expenditure per car per day;
   — average number of persons per car;
   — number of persons;
   — number of person-days;
   — average expenditure per person per day;

Also: (for non-residents only): By U.S. state of registration:

   — entries on customs permits as per cent of automobile registrations;
   — average declared expenditure per car;
   — total expenditure;
   — average length of visit;
   — average expenditure per car per day.

2. Non-resident automobiles travelling on customs permits which departed from Canada in 1958:
   - number of automobiles—by length of visit (1 day; 2 days; 3 days and over):
     - by port of entry and port of exit;
     - separately for 9 main regional categories—traffic within Ontario;
     - traffic from Ontario to other provinces;
       traffic Maritimes to other provinces;
       Manitoba to other provinces, etc.;
   - number of automobiles—by U.S. state and by province of entry (Newfoundland, Prince Edward Island and Nova Scotia totalled; other provinces and Yukon separately);

Separate data for those remaining in Canada 3 days or over:

   - average declared expenditure per car—by U.S. state and "total remaining states and foreign countries".

3. Canadian travellers returning to Canada in 1958:
   By days' stay; separately via rail; via bus; via plane:
   - number of persons;
   - per cent of total persons;
   - average expenditure per person;
   - estimated expenditures;
   - per cent of total expenditures;
   - number of person-days;
   - average expenditure per person per day.
4. By each state of destination reported by Canadian visiting 48 hours or over:
   - per cent of total persons, by quarters of the year. Also by province of re-entry into Canada.
5. Number of foreign automobiles and other vehicles entering Canada:
   - separately for non-permit class—local traffic;
     travellers' vehicle permits; commercial vehicles;
   - by province of entry; also by month of entry.
6. Number of foreign travellers entering Canada from U.S.; also number of Canadians returning from U.S.:
   - by province of entry; also by month of entry;
   - separately by rail; boat; bus; aeroplane.
7. Number of Canadian automobiles and other vehicles travelling in U.S.:
   - by province of re-entry into Canada;

— also by month;

— separately for length of stay—24 hours or less; over 24 hours; commercial vehicles.

56 tables; 3 charts; 2 maps; 11 forms; 100 pages.

Prepared in International Trade Division: Balance of Payments Section.

Road and Street Mileage and Expenditure, 1958 (formerly Highway Statistics)

DBS 53-201. Annual. Price: 50¢.

For each province and territory:

1. Per capita highway and rural road expenditure.
2. Highway and rural road expenditure:
   — total; federal; provincial; municipal expenditures; breakdown for construction; maintenance; administration and general;
   — net subsidies and grants in aid.
3. Revenue earned by:
   — domestic toll bridges, tunnels and ferries;
   —controlled access toll highways.
4. Urban street expenditure:
   — number of authorities;
   — expenditure detail for: construction; maintenance; administration. Separately for roadways; bridges and ferries; sidewalks and footpaths;
   — subsidies paid; received.
5. Trans-Canada Highway expenditure:
   — total; federal expenditure; grants to provinces.
6. Expenditure for elimination and protection of grade crossings:
   — by railways; from Railway Grade Crossing Fund; by provinces and municipalities.
7. Highway and rural road mileage, by type of surface;
   Also: average number of motor vehicles per mile of surfaced road—total Canada only.
8. Urban street mileage:
   — by type of pavement.
   10 tables; 15 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

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3. URBAN TRANSIT

Urban Transit, March 1960

DBS 53-003. Monthly. Price: $1.00 per year.

Class I carriers only.

For each province (except Prince Edward Island).

1. Number of passengers; Number of vehicle-miles run; } separately for: electric car; trolley coach; motor bus; chartered.
2. Gallons fuel—gasoline; diesel oil; liquefied petroleum gases.
3. Total revenue ($).
4. Number of firms reporting.
   2 tables; 1 graph; 4 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Urban Transit, 1958

DBS 53-216. Annual. Price: 50¢.

A. For 77 urban transit companies earning annual gross revenues of $20,000 or more and covering 90 per cent of operations of the industry. Exclude taxicabs; suburban rail lines, ferries, school buses. Statistics given for:
   Total all companies; also separately for each of 13 major urban transit systems:
   1. Balance sheet—breakdown of total assets and total liabilities.
   2. Income Account:
      — operating revenue—passenger; other;
      — operating expenses—wages; fuel; operating taxes and licences; etc.;
      — lease of transit property—rent; income;
      — other income;
      — interest, etc.;
      — provision for income tax.
   3. Traffic statistics:
      Separately by class of equipment—electric car; trolley coach; motor bus; subway car; chartered:
      — revenue passengers;
      — revenue vehicle miles;
      — seat miles available;
      — route miles one way;
      — revenue vehicle hours.

4. Revenue equipment—number:
   Separately by class of equipment—electric cars; trolley coaches; motor buses; subway cars:
   Also: for total all companies only:
   — number, by seating capacity.
5. Fuel—gallons—gasoline; diesel oil; liquefied petroleum gas.
6. Employees—number; salaries:
   — by type of employee.
7. Number of accidents—for total all companies only:
   — by class of equipment—electric car; trolley coach; motor bus; other;
   — by type of accident;
   Persons killed; injured—by type of person:
   — by cause of accident;
   — by class of equipment involved.
8. Fares charged (detail)—for each of 13 major urban transit systems only.

B. For urban transit operations of intercity and rural passenger carriers:
   — passenger revenue;
   — revenue vehicle-miles run;
   — revenue passengers carried.
   18 tables; 20 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

4. WATER

Shipping Statistics, February 1960

DBS 54-002. Monthly. Price: $2.00 per year.

1. Cargoes unloaded, also loaded at: Atlantic and St. Lawrence River ports, Montreal and below; Great Lakes and St. Lawrence ports above Montreal; Pacific ports: (tons)
   — for foreign countries; for each of 17 commodities;
   — in coastwise shipping; for each of 13 commodities.
2. Number of registered net tonnage of vessels arrived at, also departed from, selected Canadian ports:
   — in foreign service; for each of 26 ports, also totals for: Atlantic and St. Lawrence River ports, Montreal and below; Great Lakes and St. Lawrence ports above Montreal; Pacific ports;
   — in coastwise shipping; for each of 26 ports.

53744-9—34½

3. Cargoes unloaded, loaded in foreign, also coastwise, shipping at each of 26 selected Canadian ports by commodities (a few commodities for each port).

   6 tables; 8 pages.

Shipping Report, 1958, Part I: International Seaborne Shipping

DBS 54-202. Annual. Price: $1.50.

1. Cargoes loaded (tons) at Canadian ports:
   - for each foreign country;
   - by registry of vessel;
   - separately for: total Atlantic and Lower St. Lawrence ports, Montreal and below; Great Lakes and Upper St. Lawrence ports above Montreal; Pacific ports;
   - separately for each commodity.

   Totals for each commodity also given; classified by port areas in Canada.

2. Cargoes unloaded (tons) at Canadian ports: (same detail as in 1.).
3. Number and registered net tonnage, also tons of cargo carried, by vessels arrived at, also departed from, Canadian ports in international shipping:
   - separately for: total Atlantic and Lower St. Lawrence ports, Montreal and below; Great Lakes and Upper St. Lawrence ports above Montreal; Pacific ports;
   - separately for each country.

   5 tables; 1 chart; 103 pages.

   Prepared in Transportation Section of Public Finance and Transportation Division.

Shipping Report, 1958, Part II: International Seaborne Shipping

DBS 54-203. Annual. Price: 75¢.

1. Cargoes (tons) loaded, also unloaded, from foreign countries:
   - at each port (by provinces and Northwest Territories);
   - by commodities (a few commodities and "general cargo" for each port).
2. Number and registered net tonnage of vessels departed from Canadian ports in international seaborne shipping:
   - by rig (steam; motor; sail; unrigged);
   - by size group (registered net tons);
   - by provinces and Northwest Territories.

3. Number and registered net tonnage of vessels arrived at, also departed from, Canadian ports in international shipping:
   — at each port (by provinces and Northwest Territories).
4. Number of vessels; registered net tonnage; cargo unloaded or loaded in respect to cargo shipped to and from foreign countries via the St. Lawrence River:
   — at each Great Lakes port;
   — by commodities (a few commodities and "general cargo" for each port).
5. Number and gross tonnage of tugs and number and registered net tonnage of fishing vessels departed from Canadian ports in international seaborne shipping:
   — from each port (by provinces).
   10 tables; 171 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Shipping Report, 1958, Part III: Coastwise Shipping

DBS 54-204. Annual. Price: 75¢.

1. Cargoes loaded, also unloaded, at Canadian ports in coastwise shipping:
   — for each port (by provinces and Northwest Territories);
   — by commodities and "general cargo".

Totals for each commodity also given; classified by port areas in Canada.

2. Number and registered net tonnage of vessels arrived at, also departed from, Canadian ports in coastwise shipping:
   — for each port (by provinces, and Northwest Territories).
3. Number and registered net tonnage of vessels departed from Canadian ports in coastwise shipping:
   — by rig (steam; motor; sail; unrigged);
   — by size group (registered net tons);
   — by provinces and Northwest Territories.
4. Number and gross tonnage of tugs and number and registered net tonnage of fishing vessels departed from Canadian ports in coastwise shipping:
   — at each port (by provinces and Northwest Territories).
5. Tonnage of cargo unloaded at Canadian ports in interprovincial and intra-provincial trade:
   — by province of loading and province of unloading.

6. Cargo loaded and unloaded (tons) in coastwise shipping by vessels of foreign registry; number of vessels; registered net tonnage:
   — by country of registry;
   — separate totals for: Atlantic and Lower St. Lawrence River ports; Great Lakes ports; Pacific ports.

   18 tables; 270 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Water Transportation, 1958

DBS 54-205. Annual. Price: 50¢.

Vessels operated by 358 Canadian-owned companies.
Includes vessels of CNR Newfoundland Coastal Steamship Service.
Excludes vessels used solely by industrial companies for transportation of own cargoes.
All following data are given separately for:
— each division—Atlantic; Pacific; Great Lakes; Inland;
— incorporated companies; individual ownership and partnership.

1. Property account: ($)
   — land; vessels; docks; wharves and warehouses; accrued depreciation; etc.
2. Income account: Operating revenues (passenger; freight; towing; salvage; storage; charter);
   Operating expenses (maintenance; operation; taxes; income tax; etc.)
   Other income; Other expenses.
3. Employees—number and salaries:
   — separately for vessel crews; dock and warehouse; office administration; other employees.
4. Fuel—quantity and cost:
   — coal; fuel oil; diesel oil; gasoline.
5. Vessels, owned or chartered, in operation during and at the end of season by Canadian marine operators; also owned vessels not operated:
   — separately for passenger; passenger and freight; tanker; tugs; tow barges and scows; miscellaneous.
6. Number of persons killed; injured in Canadian water transportation industry:
   —by type of person;
   vessels lost—number and value.

   9 tables; 11 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Summary of Canal Statistics, December 1959

DBS 54-001. Monthly. Price: $1.00 per year.

1. Following data are given:
   — number of vessel passages;
   — registered net tonnage of vessels;
   — number of passengers;
   — number of pleasure craft;
   — tons of freight;

   with following breakdown:
   —for each of 11 Canadian canals;
   —by direction of traffic for each of: Sault Ste. Marie; Welland; St. Lawrence canals;
   — separately for Canadian lock; Canadian and U.S. locks of the Sault Ste. Marie Canal.
2. Tons of freight—by commodities:
   — for Sault Ste. Marie Canal—Canadian lock; Canadian and U.S. lock; separately for eastbound and westbound;
   — for Welland Canal and for St. Lawrence canals—separately for bulk; general; also separately for eastbound; westbound.

   2 tables; 3 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

Canal Statistics, 1958

DBS 54-201. Annual. Price: 75¢.

Graphs:

— total freight traffic through Canadian canals 1940-58 (tons);
— freight traffic through Welland; St. Lawrence; Sault Ste. Marie canals 1940-58 (tons);
— vessel traffic through Welland; St. Lawrence; Sault Ste. Marie canals 1940-58 (thousands of vessels).

Statistical tables:

1. For each of 11 Canadian canals:
   — number of vessels (Canadian; U.S.; U.K.; other);
   — passengers;
   — registered net tonnage—by rig; also breakdown by Canadian; U.S.; U.K.; other;
   — cargo tons—by commodities—breakdown of some by direction of traffic;

   Also: cargo tons up; down and cargo tons by country of loading and unloading (Canada; U.S.; U.K.; other).

2. Cargo tons carried in interlake traffic (lake of origin and destination).
3. Number of vessels upbound; downbound through St. Lawrence canals to or from outside points;
   Also: number of tons cargo carried up; down St. Lawrence canals to or from outside points.
4. Number of bushels of grain (by commodity) downbound through Welland Canal between Canadian and U.S. ports:
   — by country of origin of vessel;
   — by country of registry of vessel;
   — separately for Canadian and American grain.
5. Freight carried (tons) through St. Lawrence canals:
   — by country of registry or vessel (Canada; U.S.; U.K.; other);
   — separately for cargo of U.S.; Canadian; and several other countries' origin—breakdown into up; down.
   Similar tables for Welland and for Sault Ste. Marie Canals.
6. Number and registered net tonnage of vessels using each canal by origin and destination of vessel; by country of registry; by rig:
   — by direction, up or down.
7. Number and registered net tonnage of vessels using Welland; Sault Ste. Marie; St. Lawrence canals by kind of vessel (freight; passenger; freight and passenger; tanker; scow or barge; other):
   — by length; also by draft;
   — by direction, up or down.
8. Traffic through Canadian and U.S. Sault Ste. Marie Canals:
   — cargo tons, by commodity;
   — vessel passages;
   — registered net tonnage of vessels;
   — passengers;
   Breakdown:
   — by direction, up or down;
   — Canadian canal; U.S. canal.
9. Freight (tons) carried through each canal by country of loading and unloading of cargo:
   — by commodities;
   — by direction, up or down.
10. Number of passengers carried through each canal:
    — by country of origin and country of destination;
    — by direction, up or down.
11. Number of pleasure craft lockages, each canal.
12. Length of season of navigation for each canal.

13. Location and description of canals; length; number and dimensions of locks.
14. Water freight charges on the Great Lakes:
    Fort William-Port Arthur to various ports, for wheat; barley and oats; flax and rye; by months:
    — average charge per bushel;
    — average charge per ton;
    — average charge per ton-mile.
    32 main tables; 3 charts; 51 pages.

Prepared in Transportation Section of Public Finance and Transportation Division.

St. Lawrence Seaway: Preliminary Toll Traffic Statistics, April 1960
Monthly. (No price listed)

Separately for each of 2 sections (Montreal-Lake Ontario; Welland) and for direction of traffic, up or down:
— number of transits;
— bulk cargo;
— general cargo;
— total cargo.
One page; one table.
Prepared by the St. Lawrence Seaway Authority.
(Mimeographed).

Traffic Report of the St. Lawrence Seaway, 1959

Price: 50¢.

Prepared for the St. Lawrence Seaway Authority and the St. Lawrence Seaway Development Corporation, Cornwall, Ontario.

A. For St. Lawrence Seaway, separately for each section:
   Montreal—Lake Ontario; Welland Canal:
   1. Data on traffic, etc., are broken down as follows:
      — by direction, up or down;
      — by type of vessel (cargo; cargo with passengers; scow or barge; tanker; tug; pleasure craft; other); separately by origin of cargo—Canada; U.S.; foreign.

Also by type of cargo (bulk; general; mixed; passengers; in ballast—ocean; laker; pleasure; other).

The data given in this breakdown are:
— number of transits;
— net tons;

— gross tons;
— cargo tons;
— passengers;
— toll revenue;
— per cent of total toll revenue.

2. By origin and destination of transit (Canada; U.S.; foreign); separately by direction, up or down.

The following data are given:

— number of transits;
— gross tons;
— toll revenue.

3. Cargo tons:
— by origin and destination (Canada; U.S.; foreign);
— by type—bulk; general;
— by direction, up or down.

4. For each class (ocean; laker):
And for each type of vessel (cargo; etc.); also for each class of cargo (bulk; general; mixed; in ballast) and pleasure craft and other.

The following data are given:
— number of transits;
— gross tons;
— cargo tons;
— toll revenue;
— average revenue per transit.

5. By length of vessel;
Also by size of vessel in gross tons;
Also by country of registry.
With breakdown by direction, up or down, the following data are given:
— number of transits;
— net tons (for length of vessel, but not for size or registry);
— gross tons;
— cargo tons (for country of registry; breakdown by type of cargo—bulk; general; mixed);
— toll revenue.

6. Cargo tons—by commodities and "general and mixed cargo"; "package freight—domestic"; "package freight—foreign":
— by type of cargo (bulk; general);
— also by country of origin and destination (Canada; U.S.; foreign); separately by direction, up or down.

B. Total seaway traffic:

1. Cargo tons—by type of cargo (bulk; general):
   - — through each of 24 Canadian ports and "Other Canadian ports", separately for inbound; outbound;
   - — also through each of 15 U.S. ports and "Other United States ports", separately for inbound; outbound.
2. Vessel transits through: Iroquois Lock; Lock 8—Welland:
   - — for each day of navigation season;
   - — by direction, up or down.
3. Cargo tons all traffic; also toll traffic (cargo tons; passengers); by months; separately by direction, up or down:
   - — for Montreal—Lake Ontario section;
   - — for Welland Canal section.
4. Non-toll traffic:

   Separately for Montreal—Lake Ontario section; Welland Canal; Sault Ste. Marie (Canadian); Lachine; Cornwall Canal:
   - — by type of vessel:
     - — number of transits;
     - — net tons;
     - — gross tons;
     - — cargo tons;
     - — passengers (Sault Ste. Marie (Canadian); Lachine Canal only).

   By commodity and "general and mixed cargo", "package freight-domestic", "package freight—foreign", and by type of cargo (bulk; general):
   - — for Sault Ste. Marie (Canada); Lachine; Cornwall canals only:
     - — cargo tons.

   42 tables; 46 pages.

Prepared by the St. Lawrence Seaway Authority.

Annual Report of the National Harbours Board For Calendar Year 1959

Price: 25¢.

This publication is produced by the National Harbours Board. Although annual reports of government agencies are generally omitted from this Appendix (which describes only statistical periodicals relating to transport), this report contains so much statistical material bearing directly on water transport as to merit inclusion.

Numerous financial and statistical tables appear in this report. Some appear in the text, while others are financial statements of the National Harbours Board which follow the text. In addition there is a section of tables dealing with specific ports, bridges, and elevators.

Statistical material in the text of the report includes:

1. Number of vessels arriving, departing, and registered net tonnage, 1955 to 1959.
2. Cargo tonnage inward, also outward, by foreign ships; domestic ships—1955 to 1959.
3. Comparative consolidated income statement of the National Harbours Board.
4. Operating income; operating expense; net operating income for each of several ports and the Jacques Cartier Bridge, 1955 to 1959.
5. Capital expenditures at each of several ports, etc.
6. Amounts required from the Government and paid to the Government.

Following the text is a balance sheet and a statement of income and expense of the National Harbours Board.

At the end of the text, the following statistical and financial data are given (where applicable) for each of: Ports of Halifax, Saint John, Chicoutimi, Quebec, Three Rivers, Vancouver; Jacques Cartier Bridge; Prescott elevator; Port Colborne elevator:

1. Number of vessels and net registered tonnage:
   arrivals; departures. Separately for deep-sea or ocean-going commercial; coastal or inland commercial vessels, including fishery; other.
2. Cargo tonnage inward; outward—by commodities.
3. Passengers landed; embarked—separately for foreign; coastwise.
4. Grain elevator; receipts (bushels); shipments—separately via rail; water; other.
5. Balance sheet.
6. Statement of income and expense.
   National Harbours Board.

5. AIR

Civil Aviation, December 1959

DBS 51-001. Monthly. Price: $2.00 per year.

1. Separately for: Canadian carriers domestic scheduled—Total and also each of 6 carriers; Total domestic non-scheduled; Total trans-border;

Atlantic and Pacific services—Total; Trans-Canada; Canadian Pacific; and Foreign carriers (trans-border; Atlantic and Pacific services). Also: Non-scheduled domestic—Total; Class "B" carriers; Class "C"; Class "D" carriers:

The following data are given:

- — miles scheduled;
- — non-revenue miles flown (for each of 6 Canadian scheduled carriers only);
- — revenue miles flown—unit toll; bulk;
- — hours flown—non-revenue; revenue—unit toll; bulk; other;
- — fuel—gallons; cost—separately for: turbo fuel; gasoline; also oil—turbo aircraft; other aircraft;
- — average number of employees; salaries and wages;
- — average number of aircraft—owned; leased;
- — ratio of miles flown to miles scheduled (where applicable);
- — revenue passenger load factor—scheduled;
- — revenue passengers carried—unit toll; bulk;
- — passenger-miles unit toll; revenue; non-revenue;
- — freight carried: non-revenue; revenue—unit toll; bulk;
- — ton-miles freight unit toll: revenue—non-revenue;
- — express carried (lb.) unit toll;
- — express ton-miles unit toll;
- — excess baggage (lb.) unit toll;
- — excess baggage ton-miles unit toll;
- — mail carried (lb.) unit toll;
- — mail ton-miles unit toll.

2. For each of 6 scheduled Canadian carriers; for non-scheduled Class "B"; "C"; "D" carriers; for Atlantic and Pacific services—Trans-Canada; Canadian Pacific:

The following additional data are given:

- — revenue passengers carried scheduled (originated; domestic interline; foreign interline; division interline);
- — revenue passengers—non-scheduled;
- — revenue freight carried scheduled (originated; etc.);
- — revenue freight non-scheduled unit toll;
- — revenue express carried scheduled (originated; etc.);
- — express—non-scheduled;
- — revenue excess baggage carried (originated; etc.);
- — excess baggage—non-scheduled;
- — available seat miles—scheduled;
- — available ton-miles—scheduled.

3. For Canadian carriers total scheduled; total non-scheduled; for each of 6 scheduled Canadian carriers' domestic services; for non-scheduled carriers' domestic services—Class "B"; Class "C" carriers:

— operating revenues: Unit toll (passenger; mail; freight; express; excess baggage); bulk; other flying services; non-flying services;
— operating expenses: Aircraft operation and maintenance; ground operation and maintenance; traffic; general administration;
— general taxes; income taxes;
— operating ratio.

11 tables; 2 graphs; 15 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Civil Aviation: Preliminary Annual, 1958

DBS 51-201. Annual. Price: 50¢.

Statistics are identical with those in DBS 51-001 *Civil Aviation, December 1959* (monthly) except that in the annual publication they are on an annual basis. Also where 6 Canadian scheduled carriers appear individually in the monthly publication, 7 appear in the annual edition (Austin Airways added).

14 tables; 13 pages; 2 graphs.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Civil Aviation, 1958

DBS 51-202. Annual. Price: 50¢.

All of the statistics which appear in the monthly (DBS 51-001) and preliminary annual (DBS 51-201) editions of *Civil Aviation* are also included on an annual basis in this publication.

There is also the following additional data:

1. For Canadian scheduled carriers—Total; each of 7; also non-scheduled Canadian carriers—Total; Class "B"; "C"; "D" carriers:
   — balance sheet;
   — current assets;
   — investments; deferred debt; special funds; (scheduled only);
   — fixed assets less depreciation;
   — current liabilities;

— long-term debt; deferred credits; reserves; (scheduled only);
— capital stock;
— surplus;
— property account (omits Total—non-scheduled; Class "C" and "D" carriers):
  — property and equipment (detail);
  — additions, retirements, depreciation (detail);
— statement of earned surplus (omits Total non-scheduled; Class "C" and "D" carriers).

2. Employees; salaries and wages:
   — by type of employee, for total Canadian and foreign air carriers;
   — for each of 7 scheduled carriers; Class "B"; "C"; "D" carriers; foreign carriers (trans-border; Atlantic and Pacific services).
3. Accidents involving Canadian air carriers:
   — number of casualties—fatal; serious; minor—by type of person;
   — number of accidents—by operational phase; also by type of flying;
   — per cent of total accidents—by probable cause.
4. Personnel licences (by type); aircraft registered (by type); airport licences; number in force December 31, 1957, and December 31, 1958.

   19 tables; 4 charts; 18 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Air Transport Board

Origin and Destination Statistics: Mainline Scheduled Traffic Survey of Revenue Passengers, 1955-1959

(No price listed—not for general sale)

Scheduled passenger traffic between points in Canada, and between Canadian and U.S. points (Canadian carriers only)—4 weeks' sample, March 17 to 31 and September 1 to 14 in each of five years. Sample taken from first ticket lifted by participating carriers (Trans-Canada Air Lines and Canadian Pacific Air Lines). Sample not blown up to an annual basis, but data are shown separately for March and September of each year:

— number of passengers between Canadian stations, origin and destination, domestic traffic;

— number of passengers between Canadian stations and TCA terminal points in U.S., origin and destination.

Prepared by the Statistics Section of the Economics Division, Air Transport Board.

3 parts, tables not numbered, 186 pages.

6. PIPELINE

Oil Pipeline Transport, April 1960

DBS 55-001. Monthly. Price: $2.00 per year.

1. Oil (barrels) carried by pipelines, separately for trunk and gathering lines:
   — received: — own gathering system;
   — other pipelines—gathering trunk;
   — originating on own trunk lines;
   — received from foreign pipeline connections;
   — received from other carriers (total rail and truck);
   — delivered: — to other Canadian trunk lines;
   — terminated on own trunk lines;
   — delivered to foreign pipeline connections;
   — delivered to other carriers (total truck, rail and water).
2. Oil (barrels) carried by pipelines, separately for gathering; trunk:
   — by province in which shipments originated;
   Also, oil delivered, separately for gathering; trunk lines, by province in which shipment terminated or was delivered to other carriers.
3. For each of 5 pipelines and "other pipelines":
   — traffic — total barrels oil received into;
   delivered out of system;
   — barrels handled, daily average — gathering lines; trunk lines;
   — barrel-miles — trunk lines;
   — average miles per barrel (trunk lines);
   — operating revenues — quarterly;
   — number of employees; salaries and wages;
   — man-hours worked by wage earners.
   6 tables; 2 charts.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Oil Pipeline Transport, 1958

DBS 55-201. Annual. Price: 50¢.

1. For total all companies:
   Oil (barrels) carried by pipelines, separately for trunk and gathering lines:
   — received: — own gathering system;
     — other pipelines — gathering; trunk;
     — originating on own trunk lines;
     — received from foreign pipeline connections;
     — received from other carriers (total rail and truck);
   — delivered: — to other Canadian trunk lines;
     — terminated on own trunk lines;
     — delivered to foreign pipeline connections;
     — delivered to other carriers (total truck, rail and water).
2. For total all companies:
   Oil (barrels) carried by pipelines, separately for gathering; trunk:
   — by province in which shipments originated;
     Also, oil delivered, separately for gathering; trunk lines, by province in which shipment terminated or was delivered to other carriers.
3. For total all companies:
   Oil carried by pipelines by month in which shipment originated, separately for gathering; trunk lines.
4. For each of 23 companies:
   — barrel-miles transported by trunk lines.
5. For each of 20 companies:
   — mileage of gathering system;
   — barrels handled, daily average;
   — barrel-miles during year;
   — pumping stations on trunk lines, by rated horsepower.
6. For each of 32 companies:
   — oil pipeline fill (barrels), separately for gathering; trunk lines;
   — oil pipeline mileage, separately for gathering; trunk lines, by province; also by pipe diameter (inside) in inches.
7. For total all companies and for each of 32 companies:
   — assets (detail);
   — liabilities (detail);
   — property account (detail);
   — operating revenue—from gathering; trunk line operations; other;

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— other income;
— operating expenses—maintenance; transportation; general office; other;
— other expenses; depreciation; interest;
— income tax.

8. Average number of employees and total earnings:
   — by general office; clerical; supervisory and occupational; wage earners;
   — by provinces.

   22 tables; 1 chart; 20 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Gas Pipeline Transport, May 1960

DBS 55-002. Monthly. Price: $2.00 per year.

For each of 16 natural gas transmission companies:

1. Natural gas received into system: (thousand cubic feet)
   — from each source: own gathering systems; other gathering systems; foreign transmission lines; Canadian transmission lines; storage;

   Also: Natural gas delivered out of system:
   — to each of: distribution systems; foreign transmission lines; industrial users; others; Canadian transmission lines; storage.
2. Pipeline fuel;
   Pipeline losses and metering differences;
   Line pack fluctuations.
3. Send-out; daily average; peak day of month.
4. Total operating revenue.
   8 pages; 1 chart; 3 tables.

Prepared in Public Utilities Section of Public Finance and Transportation Division.

7. WAREHOUSE AND STORAGE

Warehousing, 1958

DBS 63-212. Annual. Price: 50¢.

Data for 213 firms offering public warehousing and storage. Firms included in *Warehousing* or *Motor Carriers—Freight* according to predominant source of revenue.

1. Totals, by provinces:
   — number of companies reporting;
   — property account—land; warehouses, garages, etc.; trucks, trailers, service cars, and other vehicles; etc.;
   — operating revenue—storage revenue (household goods; dry merchandise; refrigerated storage); cartage—railway and other local; handling and extra labour service; local moving; other revenue;
   — operating expenses—wages; gasoline, oil and grease; operating taxes and licences; etc.
2. Number of employees; salaries; wages (regular; casual); withdrawals by owners or working partners:
   — by provinces.
3. Storage facilities:
   — net occupiable space in cubic feet in owned, leased warehouses;
   — by type of storage (household goods; dry merchandise; refrigerated);
   — by provinces.
4. Trucking equipment:
   Number of trucks; semi-trailers; trailers:
   — by capacity in tons;
   — by province.
5. Separately for motor carriers firms; warehousing firms:
   — storage revenue (household goods; dry merchandise; refrigerated);
   — storage facilities (cu. ft.) (household; dry merchandise; refrigerated).

   6 tables; 12 pages.

Prepared in Transportation Section of the Public Finance and Transportation Division.

Grain Statistics Weekly, July 13, 1960

DBS 22-004. Weekly. Price: $3.00 per year.

1. Visible supplies of Canadian wheat; also oats; barley; rye; flaxseed:
   — at country elevators; various ports; in transit—lake; in transit—rail (total; also western division); etc.
2. Canadian eastern grain; also United States and other foreign grain:
   — in store eastern elevators.
3. Stocks in store, by principal grades, at public and semi-public terminals; also at eastern elevators.

4. Stocks; receipts; shipments, by type of grain:
   — country elevators;
   — Fort William-Port Arthur.
5. Overseas exports of Canadian grain, by ports of loading.
6. Lake shipments from Fort William-Port Arthur:
   — by type of grain;
   — also by region of destination (Maritime ports; overseas direct; Georgian Bay and Upper Lake ports; etc.).

   24 pages.

   Prepared in the Crops Section of the Agriculture Division.

The Wheat Review, June 1960

DBS 22-005. Monthly. Price: $3.00 per year.

1. Lake shipments of Canadian grain, by type (bushels).
2. Visible supply of Canadian wheat at country elevators; in transit—lake; in transit—rail; various ports; etc.
3. Wheat shipments to United States by vessel by destination; also by rail; rail shipments of wheat from Bay, Lake and Upper St. Lawrence ports, by port of origin of shipment; rail shipments of wheat from Fort William-Port Arthur, monthly; distribution of rail shipments from Fort William-Port Arthur to Ontario; Quebec—by grade.
4. Overseas exports of Canadian grain by ports of loading, by type of grain.
5. Distribution of wheat shipments (also millfeed shipments) under the freight assistance policy, by province, by month.

   33 pages.

   Prepared in the Crops Section of the Agriculture Division.

Coarse Grains Quarterly, May 1960

DBS 22-001. Quarterly. Price: $2.00 per year.

1. Visible supply of Canadian oats; also Canadian barley; rye; flaxseed:
   — at country elevators; in transit—lake; in transit—rail (total; also western division; eastern division); interior terminals; various ports; etc.
2. Lake shipments from Fort William-Port Arthur of Canadian grain, by type, (bushels)—annually; also rail shipments from Fort William-Port Arthur, by type, monthly.

3. Freight assistance shipments of wheat; oats; barley; rye; screenings; millfeeds; by province.
   29 pages.

   Prepared in the Crops Section of the Agriculture Division.

Grain Trade of Canada, 1957-58

DBS 22-201. Annual. Price: $1.50.

Principal detail is as follows, separately for each type of grain, in bushels:

1. Primary net receipts and shipments at country elevators:
   — by crop district.
2. Car-lot receipts; primary truck lot receipts, at private terminal and mill elevators in western division.
3. Primary shipments forwarded by rail from country elevators; also from private terminal and mill elevators:
   — to Lakehead; eastern elevators; Pacific seaboard; Churchill; interior; etc.
   — also to Canadian points—eastern; western division; U.S. points;
   — also exported overseas.
4. Terminal elevators, Fort William-Port Arthur:
   — primary net receipts:
      — by months;
      — by lake; rail;
   — Also: distribution of primary shipments:
      — transfers by vessel to eastern elevators; U.S. points;
      — transfers by rail to eastern elevators;
      — domestic shipments to Canadian points, eastern division—by vessel; rail;
      — overseas.
   —Also: detail for shipments of screenings by vessel; rail.
5. Terminal elevators at each of: Vancouver-New Westminster; Victoria; Prince Rupert; Pacific Coast; Churchill; North Transcona:
   — primary net shipments—by ocean; rail (Canadian; U.S. points); Also: detail for shipments of screenings.
6. Primary net shipments from Canadian Government interior semi-public terminal elevators:
   — forwarded by rail to Lakehead; Churchill, etc.;
   — domestic shipments by rail to Canadian points—eastern; western division;
   — weight and reload, by rail to Lakehead; etc.

7. Dockage:
   — on car receipts of Canadian grain at various points;
   — on lake shipments of flaxseed and buckwheat from Fort William-Port Arthur.
8. Rail shipments of grain, separately for CNR, CPR, by months:
   — unloaded at Vancouver—New Westminster; Victoria; Prince Rupert; interior elevators; North Transcona; Churchill.
9. Lake shipments of Canadian grain and screenings from Fort William-Port Arthur:
   — to each of 15 Canadian ports;
   — to each of 7 U.S. ports;
   — also by nationality of vessel (Canadian; U.S.; foreign).
10. Detail of receipts and shipments (also: handlings) of Canadian grain at eastern elevators:
    — by origin (Western Canada; eastern country points; U.S.; etc.) and by destination (Lower Lake and Upper St. Lawrence ports; Georgian Bay and Upper Lake ports; Lower St. Lawrence ports; Maritime ports);
    — by vessel; rail.
    Same detail for total U.S. and foreign grain.
11. Visible supplies of Canadian grain in store, by weeks:
    — at western country elevators; etc.;
    — in transit, rail — western and eastern division;
    — in transit — lake.
12. Detail of Canadian grain exports:
    — by seaboard sector (via Churchill; via Fort William-Port Arthur direct; etc.);
    Also detail for countries of final destination.
13. Stocks of Canadian grain at commencement of crop year:
    — on farms; Pacific Coast elevators; etc.; in transit — rail; in transit — lake.
14. Grain storage capacity — detail by area.
15. Freight rates (¢ per 100 lbs., carload shipments); and corresponding distances (miles);
    Rail rates on grain; grain products; flaxseed; flaxseed products:
    — to Fort William-Port Arthur from individual points in Manitoba, Alberta, Saskatchewan;
    — to Vancouver; Prince Rupert; Churchill for export — from individual points in Prairies;
    — from Fort William to 6 eastern stations, for export;

— "Ex-Lake" from 3 Georgian Bay and Lower Lake ports to 5 eastern stations, for export;
— from Montreal to 3 eastern stations, for export;
— for local delivery, to Vancouver; to Prince Rupert, from individual stations in Prairie Provinces;
— "Ex-Lake" from Goderich; Midland; Port Colborne; Port McNicoll; Montreal; Fort William-Port Arthur; for local delivery to destinations in Ontario; Quebec; Nova Scotia; New Brunswick;
— from Fort William-Port Arthur to 14 stations in eastern U.S., for local delivery;

Lake freight rates on Canadian grain (¢ per bushel);
by months:
— from Fort William-Port Arthur to Georgian Bay ports; Port Colborne; Buffalo; Montreal;
— from Port Colborne to Montreal;

Weighted average rates from Fort William-Port Arthur:
— to various ports of discharge by various routes;
— separately for wheat; oats; barley, rye; flaxseed.

144 tables; 120 pages.

Prepared by the Crops Section of the Agriculture Division of Dominion Bureau of Statistics and by the Board of Grain Commissioners for Canada, Statistics Branch.

8. TRANSPORTATION EQUIPMENT

Transportation Equipment, 1957 General Review

DBS 42-201. Annual.

Dated June 1959.
Prepared in the Industry and Merchandising Division.
Price: 50¢.

Standard Industrial Classification used by Dominion Bureau of Statistics provides for a separate Transportation Equipment group. This group includes the following industries: aircraft; shipbuilding; bicycles; boat building; motor vehicles; motor vehicle parts; railway rolling stock; miscellaneous. There is a separate publication for each of these industries as well as this general review.

These publications are:

Rail

The Railway Rolling Stock Industry, 1958.
DBS 42-211. Annual.
October 1959. 50¢.

Road

The Motor Vehicles Industry, 1958.
DBS 42-209. Annual.
September 1959. 50¢.

The Motor Vehicle Parts Industry, 1956.
DBS 42-210. Annual.
50¢.

The Bicycle Manufacturing Industry, 1958.
DBS 42-204. Annual.
September 1959. 25¢.

Water

The Shipbuilding Industry, 1958.
DBS 42-206. Annual.
March 1960. 25¢.

The Boat Building Industry, 1958.
DBS 42-205. Annual.
March 1960. 50¢.

Air

The Aircraft and Parts Industry, 1958.
DBS 42-203. Annual.
January 1960. 50¢.

Miscellaneous

The Miscellaneous Transportation Equipment Industry, 1958.
DBS 42-212. Annual.
November 1959. 25¢.

In the *General Review* (DBS 42-201. Annual), there is a regional breakdown (for each province) for most of the statistics. In the separate industry publications, there is generally no information by province.

The general pattern of data presented in all these publications is:

1. Principal statistics:
   — establishments (number);
   — employees (number);
   — salaries and wages;
   — cost of fuel and electricity at plant;
   — cost of materials at plant;
   — value added by manufacture;
   — gross selling value of products at works.

   Also: Principal statistics (with some variation in detail) grouped according to size of establishment (based on reported value of production); motor vehicle industry is excepted.

2. Inventories:
   — raw materials and supplies;
   — goods in process;
   — finished goods of own manufacture.
3. Products manufactured:
   — quantity;
   — selling value at works.
4. Number of employees and earnings:
   — office and supervisory;
   — production workers (male; female).
5. Capital and repair expenditures in industry:
   — capital expenditures (construction; machinery and equipment);
   — repair expenditures (construction; machinery and equipment).
6. Imports and exports, by products:
   — quantity;
   — value.
7. Fuel and electricity, by type of fuel:
   — quantity;
   — cost at works.

   Materials used, by type:
   — quantity;
   — cost at works.
8. List of firms included.

For the Motor Vehicles industry, the following additional data appear:

— registrations;
— apparent supply of motor vehicles (detail);
— estimate of motor vehicles withdrawn from use.

Road

In connection with the production and sale of motor vehicles, the following additional publications are published, all prepared by the Industry and Merchandising Division of DBS:

Motor Vehicle Shipments, June 1960.
DBS 42-002. Monthly.
$1.00 per year.

Contains monthly data on production and shipments of motor vehicles, by type of car and weight of truck or bus.

Preliminary Report on the Production of Motor Vehicles, June 1960.
DBS 42-001. Monthly.
$1.00 per year.

Brief report on total production of passenger cars and commercial vehicles.

New Motor Vehicle Sales and Motor Vehicle Financing, May 1960.
DBS 63-007. Monthly.
$1.00 per year.

Number of vehicles; retail value; and amount of financing is published, with separate tabulations for passenger cars and commercial vehicles.

New Motor Vehicle Sales and Motor Vehicle Financing, 1958.
DBS 63-208. Annual.
Dated July 1959. 50¢.

This publication is more detailed than the corresponding monthly publication. Data are provided by province and by month. Separate tabulations appear for new British and European made vehicles sold in Canada. Also information is included on financing of used vehicles.

Comment on Proposals by Canadian Pacific and Canadian National Railways Regarding Statutory and Related Rates on Grain and Grain Products in Western Canada

by

A. K. EATON

DECEMBER 1959

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Introduction

The purpose of this memorandum is to offer comment which will be useful to the Commissioners in considering proposals recommended to them by the CPR and CNR. The proposals in question are designed to offset the adverse effect on railway revenues of the frozen Statutory and Related Rates on Grain and Grain Products in Western Canada. The CNR proposal is for a simple straightforward supplement to gross revenue of an amount equal to revenue foregone through complying with statutory rates. The CPR proposal while generally similar in intent involves the use of the tax credit device. It is more sophisticated and more subtle than that of the CNR and for this reason it will need more particular comment. Accordingly to analyze its implications it will probably be helpful to set forth broadly the principles underlying the corporate income tax and the developments within the tax structure flowing from changing concepts in the fiscal field.

Principles Underlying Tax on Corporate Income in Canada

Originating in the First World War our tax on corporate income was introduced simply as part of a *general* tax on the income of persons residing in Canada. Broadly conceived the Income War Tax Act called for a levy on the income of all persons, whether natural or legally created, graduated for individuals (recognizing differences in ability to pay) but at a flat "impersonal" rate for corporate persons. Basically the sole objective was revenue. The corporation was regarded as standing by itself as a separate taxable entity with "ability to pay" quite distinct from that of the shareholders owning it. In this our tax on corporations is similar in concept to that in the United States. It departed from the pattern established in the U.K. where, although corporations pay the standard income tax, individuals receiving dividends out of profits taxed in corporate hands may claim a full offset against their personal income tax or a cash refund as the case may be. In a

sense the U.K. tax on corporations can be regarded merely as "deduction at the source". In fact, however, U.K. corporations have always paid full tax on total profits regardless of whether dividends were distributed or not. Thus on earnings retained by U.K. corporations the U.K. general income tax became, as it were, a corporate tax similar in effect to the Canadian and U.S. variety.

Since World War II these rather clear-cut lines of principle have been badly blurred. In the U.K. for example, a straight tax on corporate profits (without credits to individual shareholders) has been imposed on top of normal income tax. In the U.S. there is a minor recognition of so-called double taxation through a small tax credit to individual shareholders coupled with a minor exclusion of dividend income from personal income. In Canada the recognition of so-called double tax has gone much further and individuals are allowed a credit against personal income tax bills equal to 20 per cent of dividends received. Thus in none of these three countries is there a pure form of straight corporate tax, unrelated to personal income tax other than the upper layer of tax (10 per cent) on corporate profits in the U.K.

Unfortunately the above somewhat brief statement of principles underlying our corporate tax is not quite sufficient for purposes here, particularly since regulated companies are in the picture for consideration. The aspect of the tax which needs further special comment is the question of its incidence, that is, the question of who really bears the burden of the tax. This question flows logically from what has been stated in the previous paragraph about tax credits to individuals receiving dividends out of once-taxed profits. Until recent years it has been the generally accepted theory in both the United States and Canada that the burden of the tax on corporate profits falls upon the shareholders of the company. After all it is their ox that is being gored. Accordingly after decades of discussion and agitation among professors and students of public finance and taxation, Canada embarked in 1949 on a policy of removing this so-called double taxation by providing that individual income tax payers might take a dividend-received tax credit of 10 per cent. That is, their tax bill could be reduced by an amount equal to 10 per cent of their dividend income. This move was justified in Parliament as a step towards removing double taxation.

A rather absurd situation subsequently developed through the fact that the same Minister of Finance who introduced the tax credit later declared twice in Parliament that the corporation income tax is in practice passed on to the consumer in higher prices and accordingly could be described, in effect, as simply a sales tax. Thus after having introduced a measure to give relief to shareholders who, according to theory, bore the incidence of the corporate tax, he declared later that the tax did not fall on the shareholders at all but rather was passed on to consumers in higher prices. Subsequently

the tax credit was increased from 10 per cent to 20 per cent and at the time of announcing this increase in Parliament nothing whatever was said about removing double taxation. Rather the arguments at that time referred to the measure as one offering incentive for Canadians to acquire ownership in Canadian industry. It was supposed to improve the market for equities. Generally it was held out to be a very good thing. Thus the second half of our existing tax credit is an instance of where the tax credit device has been described as an incentive measure, that is, it is unrelated to any particular tax principle in a measure designed strictly for revenue purposes. It is a good example of the use of the tax instrument for policy purposes.

Whatever may be said in general about the incidence of the corporation tax it is quite clear that in the case of regulated industries the burden of the tax in practice is passed on to the consumer. The regulated industries regard the corporate tax simply as a cost. Perhaps most clearly has this doctrine been set forth in Bell Telephone cases before the Board of Transport Commissioners. It is argued that in order to raise capital for expansion they have to maintain their dividend rate. In order to secure one additional dollar for dividend purposes they have to ask for rate increases which will give them about $2 so that after income tax $1 will be left to support dividends so that capital may be secured in the market.

In this case then, which is the same for the railways, a dividend tax credit to the shareholders can only be justified in terms of an incentive measure. It certainly cannot be justified as a means of removing double taxation because none exists. The burden of the tax in these cases is passed on to the consumer and does not fall on the shareholders.

The purpose of dwelling here on this particular aspect of our corporate tax is twofold: (a) to show that the tax credit device has been used in this direction in Canada for policy purposes unrelated to the raising of revenue and (b) that in the case of railways no double taxation exists on the shareholders of the company because of the corporate tax being passed on to the consumer in calculations justifying the fixing of rates.

The above paragraphs have attempted to set forth the main objectives and principles of our corporation income tax. This tax is really an almost incredible phenomenon in modern capitalist society, of which the mainspring is supposed to be private enterprise. Both in Canada and in the United States, Governments over the past decade and a half have taken away about half the profits of industry. Twenty short years ago no economist or student of public finance would have believed this would have been possible. They would have flatly declared that there would be no business at all if half the rewards of risk-taking and enterprise were taken away. The fact is, of course, that during this period business both in Canada and the United States has prospered as never before and the volume of new capital investment has at

times been a positive embarrassment, leading to strong inflationary forces. This situation gives considerable support to the position of those who maintain that generally the corporation tax is passed on to consumers and is not borne by shareholders.

In the course of this upward movement in tax rates to such high levels there has been a great deal of attention devoted to improvement in the system and relief has been given in many directions for the sake of removing inequities. An outstanding example of developments of this sort is the carry backward and forward of losses so that in effect a corporation has about a seven year period of averaging.

It is probably unnecessary here to elaborate this development of alleviating provisions. It is sufficient to note that the trend has been clearly in this direction in recent years.

Policy Provisions in Income Tax Unrelated to Revenue Tax Principles

In view of the fact that CPR have recommended the use of the tax credit device under a revenue measure it is appropriate here to examine, both for the past and the present, the extent to which the tax instrument has lent itself to use for what might be called policy purposes unrelated to the general objective of raising revenue.

In paragraph 78 of their submission CPR, in proposing the use of income tax as a mechanism for granting assistance to them, make this statement:

> "The Income Tax Act has for many years been used as a vehicle for meeting National obligations and implementing National policies, for example, the special provisions dealing with mining companies in their early years, and the depletion allowance for such companies and the petroleum industry."

Unfortunately this statement relating to the mining and petroleum industry is only partly correct. These matters are never quite as simple as one would think they should be and it is necessary to devote a few pretty technical paragraphs to straighten out the picture:

(a) *3-Year Exemption for New Mines*

The Income Tax Act for many years has given new mines a three year exemption from income tax. This has clearly been an incentive measure indicating National Policy for the encouragement of mining in Canada. Regulations under this provision add greatly to its generosity through allowing mining companies to postpone capital cost allowances and write-offs for pre-production expenses

during the three year period, thus creating an extremely high and quite artificial concept of profits during the exempt period. The CPR is quite right in using this as an example. They might also have mentioned that cooperatives in Canada likewise enjoy a three-year exemption from income tax following their birthday. This is not too significant however because cooperatives do not pay much income tax anyway.

(b) *Depletion Allowances*

Perhaps no item in the Income Tax Act is so shrouded in mystery or surrounded by confused thinking as this so-called depletion allowance. The law does not even mention a "depletion" allowance, merely a special allowance for mining and petroleum companies.

In concept the allowance is quite simple. The law generally offers capital cost allowances for so-called depreciable assets such as buildings, machinery and equipment. Ordinarily in the mining industry one would likewise expect a provision allowing a company to amortize the cost of acquiring its ore body, which is a wasting asset. Apparently in the early development of income tax it was found difficult to actually determine the out-of-pocket capital cost to a company of its ore body. Most claims were acquired from prospectors for a few thousand dollars cash, with options on shares of the company formed to develop the claim. The problems inherent in this somewhat confused situation lead the authorities, possibly following a U.S. precedent, to allow a certain percentage of profits to be exempted from tax *in lieu of* amortizing the capital cost of the ore body. Rates of tax were low during this period and this simple hit or miss formula was presumably adopted to avoid complexities and argument.

Accordingly in its original form the depletion allowance was in no sense to be regarded as an incentive measure, as a concession of any kind, but was merely a device for side-stepping an awkward problem in ordinary accounting while computing profit for tax purpose.

It seems to be one of the accepted practices in Parliamentary procedure that few more words are spoken in the House of Commons by way of explanation of technical tax provisions than are demanded by the Opposition. So far as is known here there is no public statement or record in Hansard of the principles or objects regarding so-called depletion allowances. In public discussion and in the thoughts of most professional practitioners in the field of taxation and accounting the depletion allowance is regarded as an incentive measure, an exemption to encourage risk-taking and new development in the field of natural resources. So far as is known however the

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Government has never, at any time, admitted this. Perhaps, then, the CPR statement can be regarded as partially true although I know of no way in which they could prove it to a Judge.

What has been said above relates particularly to the mining industry but the presumption that the one-third exemption in the mining industry is an incentive provision does not necessarily hold true in the oil industry. Some years ago, before the oil industry developed to its present size, companies were allowed an exemption of one-third of their profits. At this time there were practically no capital costs involved in acquiring oil in place in the ground. Almost all of their outlays were on an annual basis, which were accordingly fully deductible in ordinary profit and loss accounting. During this period therefore the oil industry was getting something for nothing in a grand way. Subsequently the Alberta Government developed the practice of auctioning off so-called leases in semi-proven areas, the acquisition price being a capital sum which, in some instances, rides up to very large totals. These capital sums paid as bonuses for leases may not be amortized unless the leases are subsequently completely abandoned because they represent the very thing for which a depletion allowance was granted in the first instance.

There is one important independent oil company that has stated that it would be better off if it were allowed to amortize these large bonus payments rather than take the one-third exemption of profits. If this company is somewhere near correct in this statement then the depletion allowance in the oil industry cannot be regarded as an incentive measure. This particular company claims it is penalized by this system of percentage depletion.

The above discussion is perhaps a bit tedious but it was felt that as clear a picture as possible should be presented on this point raised in the CPR submission.

(c) *Exploration Expenses*

The CPR submission might have but did not mention the treatment in the law for exploration expenses in the mining and oil industry. In fact in this direction there is a very substantial policy concession to the mining industry but again there is not such a clear-cut basis for the same conclusion in the oil and gas industry.

During wartime, in order to encourage the development of new mines and new oil wells, the Government introduced annually for years a measure allowing mining and oil companies to charge against profit and loss account, their expenditures incurred anywhere in Canada in searching for new ore bodies and oil wells. Ordinary tax

accounting rules would not allow this kind of expenditure to qualify for deduction since they were obviously not incurred in the process of earning the income that was subject to tax. They were incurred off-property perhaps hundreds of miles from the place where their income was being earned. Accordingly it required special legislation to enable these expenses to be deducted in computing profit for tax purposes.

It was suggested above that the grounds for regarding this as a concession, while clear-cut in the mining industry, is not on such firm ground in the oil industry. The reason is this. An oil well lasts only a few years. A mine may last fifty years or more. Accordingly a company in the business of producing oil must inevitably be in the business of hunting for oil or acquiring new sources. Accordingly a broad, sensible view of the over-all operations of an oil company as a whole, could very well regard exploration expenses as part of the ordinary normal expenses of being in the business of producing oil and thus deductible. Accordingly it could be argued that in the oil industry this special provision in law is not necessary and cannot be regarded as a concession, whereas in the mining industry it clearly is a concession. A company may operate a mine for fifty years without having to look for a new one. So much for the mining and oil industries.

(d) *Tax Concessions to Shipbuilding Industry*

The CPR submission could have offered a firmer and less arguable case for the use of a tax device if they had referred to the concessions to encourage shipbuilding in Canada under the Canadian Vessels Construction Assistance Act. Under this legislation ship operators are allowed accelerated depreciation on ships built in Canadian shipyards. Likewise and very important is freedom from "recapture" in the event of sale of the ship if the funds realized from the sale are placed in escrow to be used for further shipbuilding in Canada. (Freedom from recapture means that a company is not compelled to take back into profit and loss account the selling price of the vessel where it is sold say, at original cost after it has been completely written-off in the books of the company. In this situation the net cost to the company for the vessel has been nothing. Accordingly it should be entitled to no capital cost allowance where this has happened. Under ordinary circumstances the company is deprived of all the capital cost allowances which it previously had taken. That is, it is subject to "recapture". It is freedom from this penalty that is given to vessels constructed in Canada under the Act referred to above.)

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> A further concession is offered under the Act by allowing companies to set up a reserve for quadrennial surveys instead of having to wait until the expenditure was made and then amortize it.
>
> This law giving tax concessions was introduced as a National Policy of assistance to shipbuilding in Canada.

The above items represent instances where specific industries have been offered tax concessions as matters of policy unrelated to the raising of revenue. In addition to this kind of example there are numerous cases where tax provisions have been used to achieve *general* economic and social objectives. For example in 1938 a measure to stimulate economic recovery was introduced into the Income Tax Act in the form of a tax credit for any taxpayer who would proceed with new capital investment in buildings, machinery, equipment, etc. The tax credit was 10 per cent of the amount of the capital expenditure. During wartime the Government imposed compulsory saving on top of income tax. The purpose of this was to assist in combating inflation during wartime and also it was argued that the return of these cash savings after the war would assist greatly in post-war recovery. Also in the post-war period taxpayers were allowed double the ordinary rates of depreciation on capital investment in a two-year period following the cessation of war. Similarly, though in reverse fashion, companies other than those in certain industries necessary for defence were compelled to postpone capital cost allowances on any capital expenditure incurred during a period when the Korean crisis existed.

It is clear from the above examples that tax incentive measures for special industries, as well as those of a more general nature in the economy, are a very common and well accepted feature in tax legislation in Canada. Accordingly the CPR submission is on pretty strong grounds even if they did not state their case very well.

It might be mentioned that other countries likewise use tax incentives quite freely both for the encouragement of particular industries and industry generally. In the United Kingdom for example the most significant development in recent years has been in the use of what they call "investment allowances". The principle here is that in amortizing the cost of ordinary depreciable assets the taxpayer is allowed to write off, say, an amount equal to 120 per cent of the cost. This is a straight exemption from tax of an amount of profits calculated by reference to the dollar amount of new investment. Shipowners in the U.K. enjoyed this concession for a few years to the exclusion of all others. In the last U.K. budget however this concession of investment allowances was granted to industry generally, in addition to some acceleration in depreciation allowances.

In the United States the Capital Gains Tax has traditionally been used as a device for giving relief from standard rates of tax. It has been

said by some writers that in the U.S. the Capital Gains Tax, as an instrument of tax policy, has been used more for giving relief from taxation than in imposing additional burdens. Just as an example the lumbering industry in the U.S. at one time was allowed to have the profits from standing timber taxed at the low capital gains rate rather than at the standard rate because they were using up capital assets at a very fast rate at a time when tax rates were abnormally high.

Thus, if the CPR had wished, they could have bolstered their case for the use of a tax device as a vehicle for giving effect to National policies by quoting excellent precedents in other countries as well as in Canada. It seems to me their case has been well made and that it is not necessary for them to show some similarity in the situations giving rise to the need for assistance, that is they should not have to show a clear analogy between the problem they are facing and those faced by other industries which have been assisted through the use of the tax instrument.

Direct Subsidies

No attempt will be made here to give an exhaustive review of the use of direct subsidies in Canada to assist particular industries. It will be sufficient to recognize the use that has been made of subsidies to artificially support the coal industry in Canada, as well as the livestock and poultry industries in areas of Canada distant from the source of feed grains. These facts are merely mentioned in passing as providing ample precedent for the CNR request for a direct supplement to their revenues.

Outside the field of transportation perhaps the most striking case of direct subsidy out of the Federal Treasury is found in the Emergency Gold Mining Assistance Act. In the gold mining industry the situation is quite nearly analogous to the situation facing the railways, where their selling prices of services are held down by Statute. In the case of the gold mining industry the price of gold has traditionally been fixed by Statute in Canada and although the Canadian market price is no longer fixed by Statute at home it is fixed by Statute in their chief market, the United States. The subsidy to gold mining takes the form of direct assistance geared to the costs of production in each individual mine, the high cost mines getting the greater degree of assistance. The subsidy operates under a somewhat elaborate formula to avoid, as far as possible, the charge by the chief buying country (the U.S.) that gold production *generally* in Canada was being subsidized. The general purpose of the subsidy was to prevent, if possible, the appearance of ghost towns in the gold mining areas and presumably the case for maintaining the benefits of the Statutory Rates is to prevent the appearance of ghost farms in Western Canada. The two problems are closely parallel.

Assessment of General Case for Assistance to Railways

The Commission is apparently precluded in their terms of reference from considering alterations in the Statutory Rates. Possibly however it is still open to them to comment on the significance of the type of benefit to Western grain producers under which they have been insured at the expense of other railway users against any increase in the cost measured in dollars of transporting their product to export points throughout a period when the rest of the country had to take their chances on the economic vagaries of inflation. While assuming that there may have been a case for some guarantee of stability in the *real* costs of transportation for those investing their money and their futures in Western grain areas this scarcely can justify the pyramiding of benefits which have accrued through the fall in the value of the Canadian dollar by more than half since the arrangements were entered into.

Recognizing the very practical principle in the political affairs of Democracies that benefits once uttered can never be recalled, the Commission has now to start with 1959 as a base point, pick up the pieces from there and make the best recommendations they can for the forthcoming years.

Obviously the first broad question to be answered is whether the sins of the fathers of the Crows Nest Agreement and subsequently Statutory Rates shall continue to be visited upon the customers of the railways or whether they should be shifted now to the shoulders of the Canadian taxpayers generally. This, in brief, sums up the problem in the submissions of the Railways to the Commission. The secondary questions are mainly ones of method.

The balance of argument is so strong today in favour of shifting the burden of this National Policy commitment to Western grain growers over onto taxpayers generally that probably only headings for the case need be presented here.

(a) The competitive position of the railways vis-à-vis other forms of transport becomes increasingly untenable. The basis upon which they can recoup losses forced on them by Statutory limitations inevitably becomes narrower and the distortion of "normal" rates on this account becomes increasingly severe and intolerable.

(b) It is palpably unwise economically for Canada, with such a high stake in export markets, to add in any way to the transport costs of export industries generally by shifting to them a part of the cost of assisting the grain export trade. Likewise this is quite unfair.

(c) Even in the absence of a competitive problem, leaving aside also the important aspects of export trade generally and even assuming a strongly inelastic demand for railway services, it still would not make good sense in a country such as Canada, where geography so hampers National economic development, to distort normal forces determining the location of industry by giving such a high degree of relief to one section of the economy and charging it as an expense against all others. This exaggerates existing National problems. For example it must have the effect of blurring somewhat the vision of expanding Northern development.

(d) Finally, as a matter of simple logic, if the public generally are to be called upon to support what is essentially a political policy of continued assistance to Western grain growers—and it appears that they are—then the public generally, as taxpayers, should bear the cost of this policy. The mere fact that the policy of assistance in this direction happens to take the form of transporting grain products below cost should not mean that transport costs of others in the economic community should be correspondingly inflated in order to recoup losses.

The above four points, it is believed, build up to a pretty strong case for a rather drastic departure from the status quo. The proposed shift in burden is a quite striking corrective of a situation that through the years has had to get worse before it could get any better. It is understandable that in the relatively simple and uncomplicated days of decades ago the freezing of rates for the grain trade seemed a very sensible and satisfactory way of dealing with the problem. However many things have happened in Canada in the meantime, and a rather lusty flock of chickens has come home to roost. Not least of all the things that have happened is a very fundamental change in the basic philosophy of Government. It has changed markedly from what it was even two short decades ago. Governments today take upon themselves full responsibility for the state of the economy. They presume to be responsible for all phases of the economic health of every industry. They take credit to themselves for full employment, prosperity and expanding capital investment when occasion permits them to do so and the Opposition at the same time forever attempts to pin on them full blame for all the economic ills and deficiencies, including Acts of God that we fall heir to.

What is being attempted in the foregoing paragraph is to present the idea that it is quite in keeping with the times that corrective programs in the economic field should emerge as a natural consequence of the modern attitude of Government toward affairs in the business world. Governments today are supposed to deal and deal intelligently with complicated matters such as

running railways. They are supposed to formulate National policies and place them on a sound and enduring basis. Mere makeshift improvising is no longer good enough in the present milieu. The simple fact is it is too dangerous. The new regime demands thought and care and regard for principles to a degree uncalled for in the good old days.

Technical Analysis of the Two Proposals

The general objective in the submissions put forward by both railway companies is that they should each henceforth be put substantially in the position financially which they think they reasonably would be in but for the existence of Statutory Rates. If the Commission agrees with this as a general proposition the next question is that of deciding upon the best method for giving effect to this principle. This calls for some careful analysis of the implications of the two proposals.

The first point to be observed is that while the CNR proposal for a straight subsidy would put *both companies* in the position which but for Statutory Rates they might reasonably expect to be in, the CPR proposal does this for the CPR but it does not do it for the CNR. The CNR benefit under the CPR proposal would be just half what it would be under their own proposal. The CPR formula utilizes in rather devious fashion the fact that the CPR pays income tax while the CNR does not.

Under the CNR proposal the proceeds of the subsidy would naturally be taken into corporate revenue for tax purposes just as are all income subsidies. Accordingly after tax has been paid on the subsidy (as proposed by CNR) the CPR would have left to itself from the subsidy exactly the same sum in dollars as they would receive under their own formula. The calculation is actually the same, *i.e.*, from the gross lump subtract an amount determined by applying income tax to the lump. However at this point CPR says, in effect, do not make an actual payment to us arrived at in this fashion but apply the proceeds against the tax bill we owe you. This gives them grounds then for calling the payment a tax credit and accordingly the payment (in effect) does not have to be taken into income for tax purposes. It is difficult to regard this illogical arrangement as anything other than a rather obvious piece of juggling.

Criticisms of Tax Credit Device (CPR)

(a) The first objection to the tax credit device for restoring the financial position of the railways to what it might reasonably be expected to be but for the existence of Statutory Rates is that the dollar value of the benefit passing to the railways under this CPR formula would always vary with any

future changes in the corporate tax rate. If the corporate tax rate were reduced in future the benefit to the CPR would increase, not mind you because of a change in any factor having to do with carrying grain but because of a change in some other quite extraneous factor. The reverse would be true in the case of an increase in the corporate rate.

This situation flows from the fact that in the CPR formula after setting up the amount of the addition to gross revenue which but for the Statutory Rates they might reasonably expect to receive, they then have a subtraction item, namely, an amount equal to the corporate income tax rate applied to the additional lump of revenue. Accordingly the payment to the railways—cash for CNR, an offset against a bill otherwise payable for CPR, becomes greater or less accordingly as the subtraction item becomes less or greater. This is quite indefensible in principle and just does not make good sense.

Incidentally the CPR brief in setting out their formula uses the words (para. 79(1)) "subtracting therefrom the amount arrived at by applying thereto whatever rate of income tax is applicable in the taxation year". This reference to the "rate of income tax" is a bit ambiguous. The Federal standard rate is now 50 per cent in 8 Provinces. On profits earned in Quebec the Federal Government however actually collects only 41 per cent because of an abatement of 9 percentage points to allow room for the Quebec Provincial tax of 9 per cent. It would clearly be to CPR's advantage to argue that they have in mind here Federal tax at the effective rate of 41 per cent instead of the standard rate of 50 per cent. In Ontario Federal tax is likewise abated by 9 percentage points while Provincial tax is 11 per cent, making Federal plus Provincial tax of 52 per cent. This is all very messy. In fact, however, CPR have indicated that they have in mind the 50 per cent rate which applies in the eight Provinces which do not levy corporation tax.

Recently the Minister of Justice spoke in public about a new Federal-Provincial Charter for the Provinces. Who can say what, if anything, will come out of this by way of shifts in tax sources between the two levels of Government. Thus quite apart from unilateral changes in the Federal corporate tax rate for revenue purposes in the future, even greater potential disruption to the status quo is inherent in the field of Federal-Provincial relations. To repeat, the tax level factor should not be allowed to enter as it does in the CPR formula as one of the determinants of compensation to the railways in this matter.

(b) The tax credit device obscures the essentials of the problem and disguises the real cost of the measures needed to correct it. Possibly political Governments might be pardoned for regarding at times a feature of this sort as one of great virtue but it is scarcely one that should be applauded by a Royal Commission dealing objectively with a National

problem. It is of utmost importance, of course, where such large amounts of public money are at stake that the issues be stated as clearly and simply as possible so that the public, in a fumbly sort of way, can pass judgement on them.

That this insistence on simplicity and clarity is not a purely theoretical point is illustrated strikingly in the CPR brief. For example in para. 81 their submission states:

> "The effect of the solution proposed in para. 72 is that freight assistance to the Western Grain Growing Industry to the extent of 50 per cent of the proposed level of rates would be provided."

While it is true that the benefit to the CPR and the cost to the Government for the tax credit as such amounts to only 50 per cent of the proposed hypothetical supplement to gross revenue (from which the tax credit is derived), the fact is that by not requiring this lump sum amount to be taken into income as proposed by the CNR the Government loses potential revenue equal to the tax on this lump sum supplement. In effect then the cost to the Government of assistance in this form rather than in the form suggested by CNR is 100 per cent of the lump sum supplement to gross revenue and not merely 50 per cent as suggested by CPR.

Their table under para. 82 again disregards this Government revenue factor on subsidies. The amounts shown as "Government assistance per net ton" according to my information must all be taken into gross revenue for tax purposes by persons receiving it and accordingly the Government recaptures about half these amounts which it has paid out to the companies in cash, just as for every other corporation in the country the Government takes in tax about half their profits. The result is that the final cost to the Government shown in the last column of their table is just not correct. Furthermore even if the companies concerned were not taxable in the year they received the subventions these additions to revenue would cut down their losses and thus reduce the amount otherwise available for a carry-forward to offset future profits. The CPR brief in these two directions badly confuses the issues. Their formula is completely artificial and illogical.

(c) The CPR tax credit proposal is unfair to the CNR. The proposal for a tax credit is put forward even though the CNR has traditionally not been a taxpayer, although of course it is liable for tax if and when profits emerge. The same law applies to both. The CPR proposal is that the CNR should receive payments in cash equal in dollars to the tax credit they would receive if they were a taxpayer, such tax credit being measured by the amount which would be left over for the company if the supplement had in fact been received as taxable income and taxed. Thus as stated above the payments to the CNR would be only half what they otherwise would be if a straightforward subsidy equal to revenue foregone were paid to them.

(d) It was made clear earlier in this memorandum that there is ample precedent in Canada for the use of income tax as an instrument for giving effect to National policies unrelated to the raising of revenue. The tax credit device as such, has been used to encourage capital investment (1938-39) and the dividend-received tax credit is currently operating as an incentive to Canadians to buy stocks in Canadian companies. However so far as is known there is no precedent whatsoever for the sort of use which CPR here proposes. In this instance the so-called tax credit is merely a mechanical method for effecting the payment of a sum of money by the Government to a company of an amount predetermined by a formula quite unrelated to any performance or act undertaken by the recipient. It is merely the offsetting of one debt obligation against another quite unrelated to it. This is not policy but simply mechanics. Accordingly the CPR reference in para. 78 of their submission to the use of income tax "as a vehicle for meeting National obligations and implementing National policies" is found to be scarcely relevant at all in supporting what they in fact propose.

(e) It might appear, superficially, that the CPR proposal would cost the Federal Treasury less than the CNR proposal since under the CPR proposal the cash payment to the CNR would be only half what it would be under the CNR's own proposal. If this were true it might be regarded as a point in its favour. In fact however since CNR deficits are met out of the Federal Treasury the lesser amount going to the CNR under this arrangement would merely mean that a correspondingly larger deficit had to be met by the Treasury. Accordingly it cannot be said that overall the Treasury would save money through the CPR proposal.

Miscellaneous General Comment

(a) The substance of para. 76 in the CPR submission is of fundamental importance in understanding their proposals. It shapes the whole nature of their approach to the problem. After having discussed various methods of assistance by means of direct payments or subsidies in one way or another their submission states:

> "In all the methods described above there is one basic difficulty in that it overstates the true dollar amount of assistance which the National Treasury is providing to Western wheat growers. This arises from the fact that payments would be in the nature of gross revenues and therefore in the case of Canadian Pacific would be subject to income tax and in the case of Canadian National would be applied against payments which would otherwise be the obligation of the National Treasury by virtue of the fact that Canadian National is a National enterprise."

This statement cannot be accepted in its entirety. The gross supplement to rates needed to bring the remuneration for carrying grain up to

reasonable economic levels seems to measure exactly the true dollar cost to the Treasury *and to other customers of the railways.* Income tax is one of the facts of corporate life in Canada. All industries have to take gross revenues into income for tax purposes and all have to turn about half of their profits over to the Government. No industry is allowed to short-circuit part of their gross revenue into "profits after tax" as the CPR proposes should be done. The Board of Transport Commissioners regard income tax as a legitimate cost in building a rate structure for the railways. Income tax is a National obligation. It certainly would be of real cost to the National Treasury if the Government allowed industries generally to by-pass the taxable income net with about half the gross proceeds needed from sales in order to operate economically. It is this misconception about the income tax factor contained in para. 76 which led the CPR into requesting a form of benefit (called a tax credit) which would not appear as gross revenue to be included in income for tax purposes.

(b) If the CNR proposal for a simple revenue subsidy (125 per cent of revenue from Statutory rates under CNR proposal and 100 per cent under CPR proposal) the gross amount of the subsidy both taken together would be about 71 million dollars. This, it must be admitted, is a very impressive, not to say shocking total. But surely the public is entitled to have it made abundantly clear to them what this National Policy of Statutory Rates for grain means to them in terms of dollars and cents.

While about 71 million dollars is the estimated total of the gross out-payments from the Federal Treasury the net final additional cash cost to the taxpayer is surprisingly small. First of all income tax would recapture about half of the subsidy payment to CPR, that is tax revenue would increase by about 17 million. Secondly the whole of the payment to the CNR would simply be a bookkeeping transaction so long as their deficit exceeds 35 million dollars. Under these conditions the net out-of-pocket additional cash cost to the Treasury of this clean, clear-cut simple solution would be only about 17½ million dollars unless of course simultaneously rates generally were cut for other railway customs restoring the CNR deficit to its original proportions.

There is good justification these days for being horrified at the pyramiding of fixed charges in the National Budget. However the problem involved in the railway rate structure is such an extremely serious one that some drastic move is imperative to restore order and logic in the pattern. We are fortunate in Canada in having a growth factor in our economy which, from the Federal revenue point of view keeps throwing up for use something of the order of 300 million dollars a year under conditions of normal growth and expansion. This factor helps to alleviate somewhat the fear and despair for our financial future which otherwise might overwhelm us. The 300 million odd is roughly the leverage of the tax system on normal annual increases in

gross National product. This heaven-sent annual revenue bonus in prosperous years can perhaps be regarded as a sort of reserve for absorbing the cost of past mistakes.

(c) There is always a sound cause for hesitancy in recommending direct payments out of the Treasury or beneficial provisions under tax legislation for special groups or particular industries because of the danger of creating precedents that will arise to plague the Government in future years. This point always deserves careful study. From this point of view the policy of direct assistance to the railways explored in this memorandum seems singularly free from the danger of being used as a lever for subsidies or tax abatement in other directions.

The unique feature of the present problem is that the railways are frustrated because of a Federal statute. National legislation prevents them from operating as an ordinary business concern where pricing for services rendered is a matter within their own discretion. The main issues here are simple and understandable. Federal law compels the railways to carry Western grain to export points at a figure way below the cost of doing so—at less than half of what can be established as a reasonable price. It is obviously not right to saddle the other customers of the railway with the burden of this concession. It is therefore proposed to pay the railways a fair price for performing this service ordered by Statute. What could be fairer, particularly since the over-all profit position of the railways is subject to Federal control. This, as a case, sounds all very reasonable and sensible and the policy can scarcely be represented (as CPR fears) as a measure favouring any special interests of any kind or of shielding an industry from the operations of ordinary economic forces in a free enterprise market system.

(d) Para. 61 in the CPR submission is quite blunt in its implications. The substance of it is that the agricultural economy of Western Canada is not in a position to pay a just and reasonable rate for transporting grain to export points. The clear implication of this statement is that the grain growing industry in Western Canada is uneconomic, that it must be regarded as a liability in the Canadian economy rather than an asset. This certainly brings down the status of the industry from one of grandeur to that of a kept woman. This humiliation has also happened to the gold mining industry as well as most of the coal industry in Canada. Western farmers cannot be expected to relish publicity to this situation asserted in the Joint Brief but essentially the remedies suggested are based on this unpalatable assumption.

(e) It might be pointed out that the CPR quite openly seeks assistance in a form which will avoid annual controversy when Department of Transport Estimates are before Parliament (paras. 73 and 74). This attempt to avoid the scrutiny of Parliament is perhaps an understandable objective but it

scarcely sounds decent as an argument for inclusion in a document for public consumption in a democracy. Presumably the CNR proposal would result in the annual payments appearing in the estimates although possibly some statutory authority might be taken to effect some other arrangements.

Information and Comment to be Obtained from Government Departments

Presumably the theory of the Royal Commission is that it is an independent body created to undertake an objective study of a problem and to submit recommendations for its solution. The present problem is one that potentially involves transfers of huge sums of money between two parties, Government and Railways. It would therefore seem particularly appropriate in this instance that both parties should make submissions to the Commission or at least that interested Government departments should be asked for comments on the proposals put forward by the railways. Accordingly it would seem to be in order for the Commission, if it wished to do so, to invite the views of the Department of Transport as well as of the Board of Transport Commissioners.

The Department of Finance traditionally stands in a somewhat unique position as a department of Government in that although their main interest is in the financial aspects of any problem they usually take it upon themselves to examine and pass judgement upon the basic policies giving rise to the expenditure of money. Accordingly it would not be out of line with practice to ask Finance at the official level for general comment on the two submissions. On this broad basis the comment might be expected to take considerable time in preparation and it is suggested that your approach to them might be limited to the CPR submission with particular reference to the use of income tax as a vehicle for giving effect to a policy. It could be indicated that you do not wish to impose on them the burden of an exhaustive study of the main problem but etc., etc.

As for the Income Tax Division of the Department of National Revenue the approach would be solely for information. They profess no interest in policy matters. Mainly as a matter of courtesy it would be well to ask the Deputy Minister whether in the proposals contained in the two submissions there is anything which would be awkward from the point of view of their administration. They might specifically be asked to confirm that the payments as proposed in the CNR brief would, in the absence of specific provision to the contrary, be included in income for tax purposes. They should certainly be asked to confirm or deny that the dollar benefits going to CPR under their formula would not have to be included in income for tax purposes. The point here is that this memorandum suggests that what the CPR

call a "tax credit" is in essence a thinly disguised payment and that the so-called tax credit is merely the offset of one payment against a contra-payment.

An illustration of the point being explored here might be given. Under our old Succession Duty Act in assessing a person receiving an inheritance which the testator had provided should be paid to him free of tax the Department in adding up the value of what the man received under the bequest included not only the inheritance itself but in addition an amount equal to the tax on it as well since this would be the real value of what he received. Freedom from tax is certainly worth something these days. The point of securing certainty on this question is that if the CPR assumption that this benefit through the tax offset is not taxable income is wrong their whole formula is badly shot.

As for the railways not much information is really needed from them. The Commission might like to see CPR taxable income and Federal tax actually paid thereon over the past 10 years. The company might be asked to show for each year the amount by which their tax bills would have been reduced had the offset which they now propose been operating. This is not very essential but perhaps interesting.

CNR might be asked to show their profit and loss position for the suggested 10 year period calculated under income tax accounting rules, to reveal how far they have been in each year from becoming a taxpayer. Presumably these figures would show the size of current account deficits met each year by the Federal Government. Likewise the company might be asked to show, for the period, what their profit and loss position would have been had their proposed formula been in effect.

Possibly the Board of Transport Commissioners staff has these data readily at hand and could make it available to the Commission more promptly than the railways.

The Economic Consequences of the Charges Provisions of the Transport Act of 1953

THE ECONOMIST INTELLIGENCE UNIT LIMITED,
22 Ryder Street, London, S.W.1.

JANUARY 1960

53744-9—37

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The Economic Consequences of the Charges Provisions of the Transport Act of 1953

Preface

In its Transport Act of 1953 the Government of the United Kingdom tried to reduce the regulatory handicaps of the railways in that country and to free them to compete more effectively with road and water transport. To assess the effectiveness of the 1953 Transport Act in promoting these objectives, the Royal Commission on Transportation invited the Economist Intelligence Unit to appraise the consequences of that Act. The Economist Intelligence Unit report follows.

Terms of Reference and Methods of Work

The terms of reference for this investigation were set out in letters from Mr. F. W. Anderson to the Economic Research Corporation, Montreal, dated 13th, October and 5th, November 1959. In brief, the report was to give a clear-cut statement of the intentions of the Transport Act of 1953, insofar as they related to railway charges, from evidence both prior to and subsequent to its passage, and the effects of the Act on British Railways, public hauliers and shippers of goods. Particular attention was to be paid to the following questions:

1. whether the Railways now regard themselves able to pursue a commercial pricing policy and, if not, why not;
2. whether and in what ways the "for-hire" segment of the trucking industry feels the Act has discriminated against it *vis-à-vis* British Railways and British Road Services;
3. how the private segment of the trucking industry has been affected by the Act, with supporting data on rate of growth;
4. what the stated objection to the Act has been from the regions of Great Britain where road haulage does not in effect provide alternate service to the Railways.

The analysis was to be based mainly on published sources of information.

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The report commences with a brief historical summary of Government control of railway charges in Great Britain prior to the 1953 Act. This is followed by an outline of the origins of the charging provisions of the Act and their development during the Bill's passage through Parliament. The position after the passage of the Act and the confirmation of the subsequent freight charges scheme is then considered in the light of statements by railway officers, road hauliers and traders, and the report concludes with a statistical analysis of the effects of the Act on road vehicle registrations and railway freight traffic.

The report is based on an examination of editorial opinion and statements by railway officers, road hauliers, traders and their associations, published in transport journals and in the national press, and on discussions with officers of the British Transport Commission, the Road Haulage Association, the Traders' Road Transport Association (representing "C" licence operators) and the Association of British Chambers of Commerce. Statistics of goods vehicle registrations are taken from the Ministry of Transport returns and those of railway freight traffic from British Transport Commission reports and statistical statements.

Summary and Conclusions

Although legislation to free the railways from nineteenth-century restrictions relating to undue preference, equality of charges and publication of charges was promised just before the outbreak of the Second World War, the implementation of the promise was ultimately a consequence of the 1951 Conservative Government's decision to sell publicly-owned road haulage vehicles.

Under the original draft of the Transport Bill the railways were to receive financial compensation for the loss of traffic which was expected to result from increased road competition; only minor changes in charging powers were made. Following heavy criticism of the Bill, the idea of financial compensation was abandoned and in its place the railways were freed from the obligation to publish charges, other than maximum charges, and from the restrictions relating to undue preference and equality of charges. In general, traders, road transport operators and their associations did not object to these changes and other minor ones made during the passage of the revised Bill through Parliament.

There was no criticism of the charges provisions of the Bill, or of the subsequent Merchandise Charges Scheme, from regions of Great Britain which considered that road haulage did not offer an alternative service to the railways.

Railwaymen tended to discount the effects of the ending of undue preference and equality of charges. They attached much more importance to the removal of the requirement to publish charges, other than maximum charges, and to the resultant greater flexibility in charging, which had, however, to await the confirmation of a charges scheme.

It has been held that the confirmed charges scheme, which generally implemented the principle of maximum charges related to consignment weight and loadability, left the railways "virtually free to charge what they can get, in competition, for rather less than half their freight traffic".

For a number of reasons, there was bound to be some delay, after the coming into force of the charges scheme, on 1st July 1957, before the effects of the railways' new freedom in charging began to show themselves. Important factors were the administrative work involved, the progress of railway modernisation and the decision of the British Transport Commission to retain most of the active rates for the time being.

A survey by the Association of British Chambers of Commerce towards the end of the first year of operation of the scheme showed that the effects of the charges scheme in improving the railways' competitive position were only just beginning to be felt. Nevertheless, road hauliers were, in the summer of 1958, already complaining of increased railway competition. Their implicit assertion that some of the rates quoted by the railways were uneconomic is not confirmed by the evidence available.

"C" licence operators have generally welcomed the greater freedom in charging given to the railways as an aid to more efficient and competitive working.

Statistics of road haulage vehicle registrations do not show any slowing of the rate of growth of the long- and medium-distance haulage fleets as a result of increased railway competition.

In recent months the railways have halted the decline in their general merchandise traffic. This seems to be largely due to their attempts to attract and retain traffic by competitive charging and improved services.

Government Control of Railway Charges in Great Britain

In common with other railways, British railways' freedom of charging was for more than a century restricted by legislation passed when they had, over a wide field, an effective monopoly of inland transport. As early as 1845, Section 90 of the Railway Clauses Consolidation Act (the Equality Clause) provided that the same rate should be charged for all similar consignments requiring the same or similar service over the same line of railway. Undue preference was prohibited by the Acts of 1854 and 1888 and the

1873 Act made the publication of rates obligatory. The 1888 Act also established a system of statutorily fixed maximum rates based mainly on the value of the commodity carried. Under the 1921 Act, which provided for the amalgamation of the 123 main-line companies then existing into four undertakings, maximum rates were replaced by standard charges. These charges, also based on the value of the commodity carried, were to be fixed at a level which, with efficient and economical working and management, would yield an annual net revenue, known as the "Standard Revenue", equal to that earned in 1913 plus certain additional allowances. This amounted to £51 million, but, with the growth of road competition, it was never achieved. In 1929 net revenue reached £49 million but it fell sharply thereafter to £27 million in 1932 and, despite some recovery, never reached £40 million in the period between 1932 and the outbreak of the Second World War.

Seeking to put themselves on more equal competitive terms with the road hauliers, the railways presented a memorandum to the Minister of Transport in 1938 asking for greater freedom in charging and, in particular, the repeal of statutory regulation of charges and the requirements relating to classification, publication and undue preference. This request, which was presented to the public as a demand for a "square deal", was remitted to the Transport Advisory Council for consideration. The Council arranged a series of meetings between representatives of the railways and other interests concerned and recommended the adoption of agreements reached at these meetings. Substantial concessions were to be made to the railways' demand for greater freedom in charging and undue preference was to go. An agreement between the railways' and road hauliers' representatives provided for the establishment of a committee to devise principles for the joint regulation of road and rail charges.

Shortly before the war, the Government promised legislation implementing the recommendations of the Transport Advisory Council but a few years later, in 1943, the Minister of War Transport (Lord Leathers) stated that the "square deal" failed to reach the root of the problem and some more radical solution would have to be found. The solution offered by the postwar Labour Government, in the Transport Act of 1947, was the nationalisation of the railways and their associated steamships, docks, hotels and omnibuses, London Passenger Transport, the inland waterways and most long-distance road haulage for hire or reward. Control of these assets was vested in a public corporation, the British Transport Commission, charged with the duty of providing, or securing the provision of, "an efficient, adequate, economical and properly integrated system of public inland transport and port facilities within Great Britain". The charges provisions of the Act were clearly ancillary to this central objective of the integration of

transport. Section 77 of the Act provided for charges schemes, covering any or all forms of transport operated by the Commission, which, (in the words of the Chief Charges Officer of British Railways Staff) "could have had almost any kind of mixture of fixed charges, maximum charges, minimum charges, standard charges, exceptional charges, special charges and agreed charges but, subject to the limitations of the scheme, which could have been severe, the Commission were to have an unfettered determination of the charges to be made in all or any cases". However, the Commission still had to publish their charges and they were still subject to the laws relating to undue preference and equality of charges. No freight charges scheme had been published by the autumn of 1951 when the election of a Conservative Government changed the situation again.

The White Paper on Transport Policy and the Transport Bill

The Conservative Party was committed to the denationalisation of long-distance road haulage and Government proposals for this were published in a White Paper in May 1952. There was to be a levy on all goods vehicles operating under "A", "B" or "C" licence ("A" and "B" are public hauliers' licences, "C" licences cover vehicles operated by firms for the carriage of their own goods) to cover the expected loss on the sale of the publicly-owned vehicles and to make "some provision for the loss of railway revenue arising from the further transfer of traffic to the roads". The White Paper also stated "The Commission will be given greater latitude to vary their charges schemes so as to improve the ability of the railways to compete with other forms of transport. Within prescribed limits they will be free to raise or lower their charges with subsequent approval by the Transport Tribunal and subject to the overriding powers of the Minister".

Provision for a levy for the two purposes mentioned above was included in the first draft of the Transport Bill, published in July 1952. In the charges field, Clause 19 of the Bill provided that charges schemes, which were to be reduced in scope in accordance with the emasculation of the British Transport Commission's functions proposed, would provide only for maximum charges. The discretion of the Commission to fix charges for goods within these maxima was, however, still to be restricted by the laws relating to undue preference and equality of charges and they would still have to publish their rates. The Commission's freedom to fix charges was further hampered by Clause 20 of the Bill which provided that transport operators who considered that a rate put in by the Commisison would result in a loss to the Commission, and that it had been fixed with a view to eliminating competition, might complain to the Transport Tribunal and the Transport Tribunal could, if it thought fit, order the charge to be altered.

In fact, the only benefit that the Bill conferred on the Commission was the power to increase charges by a limited amount (not more than 10 per cent) before obtaining the approval of the Transport Tribunal. By eliminating the time-lag between higher costs and high rates, provision of this kind would improve the financial position of the Commission. But it was qualified by the requirement that if the Commission took advantage of the provision it must increase all rates by the same proportion. The Commission could not discriminate between those rates where an increase would mean an increase in revenue and those where it would mean no increase or even a reduction in revenue. Thus the increased revenue obtainable from an overall increase in rates or fares of a certain percentage might be less than that obtainable from a discriminatory increase of the same amount.

Like the White Paper that preceded it, the first draft of the Bill was heavily criticised by transport operators and transport users and the Government allowed it to lapse at the end of the Parliamentary session. When Parliament re-assembled a revised Bill was produced. This second draft, laid before the House of Commons early in November 1952, limited the levy to compensating the BTC for the loss on the disposal of road haulage. The levy was no longer to provide compensation to the railways for the loss of traffic to road hauliers. Instead the railways' competitive power was to be increased. Firstly, they were relieved of the obligation to publish any charges that they applied which were less than the maximum charges laid down in a charges scheme. Secondly, once a freight charges scheme had been confirmed, the railways were to be given greater freedom to vary charges, in particular they were no longer to be subject to the laws relating to undue preference and equality of charges. This greater latitude in charging was to be limited in two ways. In the first place, the right of objection by competing transport operators provided for in the first draft of the Bill, remained in the second draft (as clause 21). Secondly, the revised Bill provided that any consignee of merchandise who could only send it by rail might complain to the Transport Tribunal if he considered that the charge requested by the railways was unfair and unreasonable, and the Tribunal, after hearing both sides, might order the charge to be altered if they considered it unjust (clause 20). In the revised Bill too, the original provision authorising the Commission to make temporary increases in maximum charges of up to 10 per cent to meet sudden increases in costs was replaced by a provision that the Commission might apply to the Transport Tribunal to authorise, without public inquiry, temporary increases that would produce not more than 10 per cent additional revenue. Insofar as it removed the need for equiproportionate increases in all rates, this was an improvement on the original clause.

Reactions to the Bill

When he opened the debate on the Second Reading of the revised Bill on 17th November 1952 (the First Reading is a mere formality, the Second Reading offers the opportunity for the main general debate on the Bill), the Minister of Transport explained the changes from the original Bill in the following terms:

> "When we introduced the earlier Bill in July, there were improvements on the old situation in the competitive position of the railways. As hon. Members will know, we introduced a head-room clause, as it is called, to provide for sudden increases in expenses to which the Commission might be subjected while the matter was being considered by the Transport Tribunal and which might land them in a very large deficit. Second, we arranged in the Bill that, instead of charges being either fixed, standard or maximum, they should be put in a charges scheme only as maximum charges.
>
> "None the less, I and my colleagues did not feel that we had fully measured up to the problems of the railways in this sphere, or to the new and tolerant view of the majority opinion in Britain towards railway obligations. As the House will know, many of these obligations on railway freedom in the matter of charges which it is proposed to sweep away under this Bill date from the days when they were a monopoly, and now there is every reason to believe that the carrying capacity of road haulage is just as high as the railway capacity."

He went on to say:

> ". . . These very great changes (i.e. in the charges provisions of the revised Bill) are, I believe, wholly desirable but I share the feeling of a number of people that some protection is necessary in the early days against the possible misuse of these great new powers. . . . We ought to do our utmost to resolve these doubts in the interest of traders—Clause 20—and in the interests of competitors—Clause 21. It may be that in the passage of time the opinion of the country may accept the fact that these protections are no longer necessary. But we have to deal with facts . . ."

In general, traders, road transport operators and their associations did not object to the Bill as redrafted. The one important exception was the Associated British Chambers of Commerce. The Associations were prepared to concede that the railways were entitled to a measure of flexibility in charging; but they were opposed to the non-publication of charges, other than maximum charges. They contended that, if actual charges were not to be published, Clause 20 of the Bill provided no adequate protection for transport users.

On the other hand, the Bill was criticised by the Parliamentary opposition, and in the technical transport press, for too severely limiting the freedom to be granted to the railways. In the first place, they considered it unfair that competitors should be able to challenge the Commission's charges, while it was not able to challenge theirs. Secondly, the greater

freedom granted to the railways was not to come into effect until a charges scheme had been prepared and confirmed. This would probably mean that several years would elapse before the railways derived any benefit from the clauses. During the passage of the Bill through Parliament, the Government made concessions to both of these views. The clause enabling competitors of the BTC to complain to the Transport Tribunal about rates fixed by the Commission was deleted and protection for road hauliers thereby eliminated. That given to coastal shipping (a traditional beneficiary) was retained by alterations to other clauses of the Bill. Further amendments provided that the railways should be released from their existing obligations relating to undue preference and equality of charges from the time of passing the Bill, instead of from the introduction of new charges schemes. The provision for temporary increases in charges was changed once again for goods charges so that, in this case, the Commission might, in order to offset a sudden increase in costs, increase all or any of the maximum charges fixed under a charges scheme by up to 10 per cent.

There was no criticism of the charges provisions of the Bill or of the subsequent Merchandise Charges Scheme from regions of Great Britain which considered that road haulage did not offer an alternative service to the railways. Criticism of the Bill by Scottish Members of Parliament was directed at the provisions for the disposal of publicly-owned road haulage, which they considered would leave some areas of Scotland with freight transport services markedly inferior to the combined road-rail services that British Railways and British Road Services were providing prior to the passage of the Bill.

The Position After the 1953 Act

The Transport Bill finally became law on 6th May 1953. From that date the railways were thus free from obligations of undue preference and equality of charges. In the eyes of most railwaymen these restraints were less important than those, e.g. publication of charges, whose demise had to await the confirmation of a charges scheme, although they were nevertheless glad to see them go. For example, in a paper read to the British Railways Western Region Debating Society in January 1954 Mr. H. D. Poole, Assistant to the Commercial Superintendent, stated:

> "We may summarize the comments on undue preference by saying that although the withdrawal of this repressive legislation will ease the mind of those who have to fix charges, it may not prove to be of such assistance as is generally looked for . . . .
>
> "The restriction (i.e. the requirement of equality of charges) was of limited scope and, in view of the fact that having granted a rate between a given pair of stations for a specific traffic the railways have

> invariably quoted that rate and its appropriate conditions to any trader who might be concerned, no difficulties have been experienced over the last quarter of a century. It may therefore be stated that the remark I made regarding the removal of undue preference applies with greater force on the equality issue."

Similar views on the ending of undue preference were expressed by Mr. A. A. Harrison, Chief Charges Officer, British Railways Central Staff in a paper read to the Institute of Transport in March 1957. He stated:

> "How far this restraint has really stopped commercial enterprise in the last quarter of a century is anybody's guess—perhaps not very far—but generations of rate men have felt inhibited by it and there has been an unconscious if not a conscious reflection of it."

The British Transport Commission (Merchandise) Charges Scheme

It was nearly two years after the passage of the Act before the BTC lodged a draft Merchandise Charges Scheme with the Transport Tribunal. (It had previously been discussed with the Traders' Co-ordinating Committee and other bodies representative of users.) The draft Scheme provided for a single set of maximum charges related to consignment weight and loadability instead of commodity value. These charges were to be based on costs of carriage in adverse conditions because, as the Commission's counsel stated at the subsequent inquiry, they must be high enough to cover "the cost of carriage in all the conditions in which the Commission have to carry traffic in significant quantities". The proposed maximum charges were, consequently, to be associated with the "outer, but not the extreme, ranges of cost".

The Transport Tribunal heard spokesmen for the Commission and objectors to the Scheme at a public inquiry extending over forty-four days between July 1955 and March 1956. In July 1956 they isssued an interim decision which represented a compromise between the views of the Commission and those of the objectors. On the one hand, they accepted the Commission's proposal for graduated maximum charges related to consignment weight and loadability. They also accepted the principle of a 10-mile standing charge, with a ton-mile progression rate thereafter, and the determination of the level of maximum charges by reference to costs incurred in adverse but not extremely adverse circumstances. On the other hand, the Tribunal decided that traffic in 100-ton consignments and in owner's wagons should be excluded from the maximum charges schedules. These were to be subject to "reasonable" charges. They also decided that there should be separate maxima for bulk traffics and other traffic and for station and private siding traffic. In all cases, the maxima were to be somewhat lower than those proposed by the Commission.

The principles laid down in the Interim Decision were implemented in the confirmed charges scheme which came into force on 1st July 1957. For the railways this meant, in the words of Mr. Harrison, "enlarged freedom in charging but by no means the complete freedom enjoyed by their principal competitors". He estimated that about a quarter of the railways' total freight revenue was accounted for by consignments of 100 tons or more and Owner's Wagon Traffic, for both of which charges were to be subject to the requirement of reasonableness. A further quarter could also be subject to the reasonableness factor through Section 22 of the Act (the section which gives traders whose goods can only be sent by rail the right to complain to the Transport Tribunal if they consider that charges are unreasonable). Finally "the authorized maxima for traffic in Commission owned wagons, in consignments of less than 100 tons, are in themselves effectively restrictive for a considerable volume of traffic. . . . I think it is fairly widely known that the authorised maxima are lower than the charges now being levied (i.e. in March 1957) for an appreciable quantity of good loading traffic passing over medium distances". The railways were consequently to be "virtually free to charge what they can get, in competition, for rather less than half their present traffic and for a share of the traffic, now on the road, much of which ought to be on the rail, at all events for its truck haul".

Freight Charges Under the Scheme

In a memorandum to the Minister of Transport in September 1956, the BTC indicated that they would use their new charging powers to encourage traffic passing in large quantities, good wagon loads and regular flows and to avoid loss, if necessary by discouraging users, on traffic passing in small consignments or over short distances. Their hopes for gains in traffic and revenue clearly centred on general merchandise traffic. In 1956 this traffic accounted for £104 million out of a total freight train revenue of £284 million, and the scope for exercising freedom in charging was greater than for other goods traffic. Railway carryings of general merchandise had reached a peak of 53.2 million tons (7,078 million ton-miles) in 1951 and fallen to 42.5 million tons (6,008 million ton-miles) by 1956.

For a number of reasons, it was to be expected that it would be some time after the coming into force of the new charges scheme before the effects of the railways' new freedom in charging began to show themselves. In the first place, although some preliminary work must doubtless have been done, there was the administrative work involved in calculating, e.g., where rate reductions would prove profitable and how they should be applied. Secondly, as the Commission's spokesmen had stressed during the public inquiry into the Scheme, exploitation of freedom in charging was closely

linked to the improvement in facilities made possible by the railways' modernisation plan. The benefits of expenditure on modernisation have been slower to mature in the freight field than in the passenger field. Finally, the Commission did not wish to annoy its customers by carrying out a revolution in freight charges overnight, even if this had been practicable. In the memorandum referred to above, the Commission declared its intention to "continue in operation most of the rates in active use at the time the Scheme comes into force . . ., for the time being, to enable a comprehensive and systematic review of such rates to be made". This review has, as the Commission promised, subsequently been carried out in consultation with representative bodies of traders.

When the Scheme came into force, the Commission continued to apply all existing rates on coal and coke; all exceptional rates on mineral and merchandise traffic used between January 1955 and July 1957 apart from "any quantity" rates not retained as 1 ton rates; most livestock rates; and all "live" rates for merchandise by passenger train except returned empties. This concession covered the bulk of wagon load traffic (consignments of 1 ton or more) then passing by railway. On the other hand, most "smalls" traffic (consignments of less than one ton), which account for over an eighth of railway freight revenue, was immediately subject to the new charges scales.

The Association of British Chambers of Commerce Survey

The results of a survey into the working of the Charges Scheme, carried out by the Associated British Chambers of Commerce towards the end of its first year of operation (and published early in July 1958), have to be interpreted in the light of the factors outlined above. As the ABCC itself admitted, the real effects of the scheme were only just beginning to be felt.

The survey, which was carried out through the ABCC's affiliated chambers of commerce, covered about 700 traders. They were asked to answer six questions, aimed at determining, from the users point of view, whether the new arrangements for freight charging were operating smoothly and whether the railways had been able to attract new traffic. The ABCC interpreted the results of the survey as showing that although the reorganisation, following the introduction of the scheme, was almost complete and the railways were showing a more commercial outlook, they still had a long way to go, as regards rates and standards of service, to compete effectively with road transport; secondly, that the scheme was operating smoothly, and users, as a whole, were experiencing few difficulties in obtaining on-the-spot quotation of rates. This, together with the quotation of high rates at the

start of negotiations often led to delays and consequent loss of traffic. Replies to individual questions were summarised as follows:

"1. *Have the railways in your area reorganised completely their organisation and charging procedure so that the new scheme is operating smoothly ?*

There is a general feeling among Chambers of Commerce that the reorganisation has been of benefit and is in the main complete; the teething troubles having been overcome, the scheme is working smoothly. However, as many exceptional rates still operate, the real effects of the scheme are only just being felt.

2. *Is there any evidence that the railways are now more competitive and commercially minded regarding rates and service than before ?*

Generally it appears to Chambers of Commerce that British Railways has become more commercially minded but not yet competitive as regards rates compared with road. There is some evidence in the replies of more competitive rates being offered particularly in those classes of traffic the railways wish to attract. There is also evidence of improvement of standards of service. There has been a marked change in the railways' selling technique, but they still have far to go in the field of quoting competitively for rates and in service.

There is still a fairly general complaint that the delegation of authority as regards rates to district officers is not operating as was expected from the traders' side. Frequently the comment is made that there is no ready on-the-spot quotation of rates, etc., without reference to headquarters. This has led to delays and loss of traffic.

3. *Is there any evidence of traffic being either won back by the railways from the road, or conversely being lost by the railways as a result of the new scheme ?*

On the whole the evidence indicates that no marked change has taken place. The trend is still in favour of road transport on account of service and less handling (even where cost is equal or lower by rail).

The comment was frequently made by companies that they use the railways little. They are not interested in the railways or the new charges scheme. Traffic continued to be lost to road on rate, speed of delivery, less handling, fewer breakages and general service. Small consignments were being lost because of high rates and traffic generally through increased demurrage charges. The railways' practice of indicating high rates at the start of negotiations did result in no further interest being taken by a potential buyer of transport. The present recession in trade, however, makes the replies to this question difficult to assess.

4. *Are your members experiencing any special difficulties under the new charges scheme ?*

The main difficulties mentioned are the increased charges for returned empties and the checking of accounts. Also comment is made on the abnormal length of time taken to quote rates and again the initial quotation of high rates. High demurrage rates are also mentioned.

5. *Have you any evidence that local railway officers are using the wagon guide scale as a rigid charge list ?*

The majority of replies were in the negative but this result should be interpreted with caution. Some of those replying in the negative did so because they are being charged their former exceptional rates. Also many answering "No" are small firms, who do not perhaps recognize the charges they receive as wagon load rates—which scale, of course, is not

made available to the public. There is, however, some indication that where the wagon guide scale has been used, chiefly in cases where traffic does not flow regularly, negotiations are possible.

6. *Is the new published small consignment scheme creating any problems?*

The general opinion is that the present small scale, as a publication is convenient, handy, and an improvement, but the level of charges in the main is considered high—even extortionate in some cases. In other replies, where the companies' traffic was previously highly classified on account of value, the level appears satisfactory. Some firms experience difficulty in checking their charges as the relevant distances are not published, and can only be obtained by reference to stations. There is a feeling that in not allowing cartage rebates from the scale, where such services are performed by traders, the railways are being unfair."

Complaints from Road Hauliers

A few months later, in October 1958, a press statement by the Road Haulage Association (the body representing private road hauliers operating for hire) indicated that in some cases, at least, the railways were making effective use of their new charging powers. The statement claimed that in order to capture traffic from road transport "some freight charges were drastically reduced, in several cases below the cost of road haulage". RHA members were said to have reported reductions from 67s 6d to 40s per ton in the rate for frozen goods from East Coast fishing ports to London and reductions of up to 30 per cent elsewhere in the Eastern Counties. The statement continued "railway rates for the carriage of potatoes from Norfolk to London have been reduced to 12s per ton*—about half the cost of road haulage; in Kent, the rate for carrying hops has been brought down below the 1947 level; in South Wales, the rate for taking tinplate to London has been reduced from 41s 3d to 32s per ton. As a result of the reduction of the railway rate for carrying goods from Consett (Durham) to South Wales at least one road haulier has been forced out of business".

The Road Haulage Association objected to the rate reductions applied by the railways on the grounds that "British Railways are not a private concern but a public body which depends on loans of public money to make good the deficits it has been incurring in recent years. . . . Road hauliers, therefore, have a legitimate cause of complaint in view of the present rate cutting policy by British Railways since not only are they adversely affected by this development but they are also members of the public that loans British Railways, through the British Transport Commission, millions of pounds annually to continue this policy". The Association suggested that some of the rates British Railways were quoting might be "so low as to be below costs and hence completely uneconomic" and supported this suggestion

* According to the railways the new rate is actually 15s per ton for 10-ton loads.

by statistics of railway freight revenue, which showed that for the first 36 weeks of 1958, during which time the new charges scheme had been in operation, revenue at £180 million was lower than in the comparable periods of both 1957 (£197 million) and 1956 (£191 million). So far as we are aware, this suggestion is erroneous; British Railways do not quote rates below the direct cost of carriage, calculated by their costing department. As subsequent analysis will show, later freight traffic statistics than those quoted present rather a different picture.

"C" Licence Operators

Operators of road vehicles under "C" licence for the carriage of their own goods are, generally, also substantial users of the railways and hired road haulage vehicles. The organisation which represents "C" licence operators, the Traders' Road Transport Association, has made no public statement on the charges provisions of the 1953 Act and their consequences but the Association has told us that its members welcome the greater freedom in charging given to the railways as an aid to more efficient and competitive working. This is broadly confirmed by statements by transport officers of leading industrial firms, who are large operators of "C" licensed vehicles. Thus, Mr. M. G. Burleigh, transport officer of Imperial Chemical Industries and chairman of the Traders' Co-ordinating Committee, which discussed the new charges scheme with the British Transport Commission, said in a paper read to the Irish section of the Institute of Transport, in April 1957, "In my view, the Transport Act, 1953, is the boldest step that any country has taken as a contribution to the solution of the major inland transport problem". In a paper read to the British Railways (London Midland Region) Lecture and Debating Society early in 1959, Mr. E. G. Whitaker, Transport Adviser to Unilever said ". . . there are many indications that the railways are taking advantage of the charging freedoms they were granted under the 1953 Act. We ourselves have instances of contracts entered into recently which I am sure will prove mutually beneficial in the long run, and others are under consideration, and one can certainly applaud the measures the railways have taken and are taking to attract traffic".

The Growth in Road Haulage Fleets

Statistics of goods vehicles licensed in Great Britain offer no clear indication of the impact on road transport of the new charging policy pursued by the railways. As Table 1 shows, although the increase in the total number of "C" licensed vehicles in 1958 was the lowest for any year from 1950 onwards, the number of larger "C" licensed vehicles (which provides a

TABLE 1—NUMBER OF ROAD GOODS VEHICLES LICENSED IN GREAT BRITAIN ON 31st DECEMBER OF THE YEAR STATED[a]

('000)

	1950	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*	*1957*	*1958*	*1959*[b]
British Road Services[c]	39.9	41.3	39.3	35.8	25.4	17.6	16.1	16.3	16.0	n.a.
Other "A" licence	56.2	53.4	53.4	68.2	79.7	91.6	97.2	100.3	100.9	n.a.
Total general haulage	96.1	94.7	92.7	104.0	105.1	109.2	113.3	116.6	116.9	118.8
"B" licence	63.1	62.5	62.9	63.6	64.6	66.5	68.9	70.7	72.6	73.7
"C" licence[d]	733.0	796.3	833.9	866.3	899.8	944.2	998.2	1,070.2	1,099.3	1,125.0
of which: Over 3 tons unladen weight	(43.3)	(49.2)	(52.8)	(56.4)	(61.3)	(67.0)	(73.3)	(80.9)	(91.4)	(100.9)
Total	892.2	953.5	989.5	1,033.9	1,069.5	1,119.9	1,180.4	1,257.5	1,288.8	1,317.5

[a]An "A" licence is a general carrier's licence, a "B" licence a limited carrier's licence and a "C" licence permits the carriage of a firm's own goods. "A" and "B" licences are granted on proof of need, "C" licences on application.

[b]30th September.

[c]B.R.S. vehicles did not require "A" licences before 1953; the decline in their numbers, and the increase in other "A" licensed vehicles, from 1952 to 1956, is mainly accounted for by the disposal of publicly-owned vehicles under the Transport Act, 1953.

[d]Many of these are local delivery vehicles; the number of vehicles over 3 tons unladen weight, broadly equivalent to $5\frac{1}{2}$–6 tons carrying capacity, is a more useful indicator.

n.a.—Not available.

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better indication of their use in long- and medium-distance haulage) increased even more than in the preceding years. On the other hand the increase in the number of "A" licensed vehicles was the lowest for six years. But 1958 was, in any case, a year of stagnation when a low rate of expansion in goods vehicle fleets was to be expected. The changes during the first nine months of 1959 throw little more light on the position, and it is clear that a longer period must elapse before one can say with any certainty whether or not the greater competitiveness of the railways has discouraged the expansion of goods vehicle fleets.

The Trend of Railway Freight Traffic

A more direct measure of the railways' success in attracting and retaining traffic is provided by their carryings of freight. The tonnage of general merchandise traffic (i.e. freight traffic other than coal, minerals and livestock) carried by British Railways reached a peak of 53.2 million tons in 1951 and has fallen in every year since then. By 1957, despite the temporary boost provided by petrol restriction in the months following the Suez campaign, it was down to 41.6 million tons, and in 1958 recession in the steel and associated industries, which provide a large proportion of the railways' merchandise traffic, brought a further catastrophic fall to 36.3 million tons. However, a comparison of the tonnage of general merchandise carried in the year prior to the introduction of the charges scheme and that carried in the two following years shows that the decline between 1957-58 and 1958-59 was smaller than that between 1956-57 and 1957-58. Carryings were 42.8 million tons for the year July 1956 to June 1957, 38.1 million tons for July 1957 to June 1958 and 35.7 million tons for July 1958 to June 1959. One cannot necessarily conclude from this that, by the exercise of their new charging powers, the railways have been able to slow down their loss of general merchandise traffic. In 1956-57 railway freight traffic was boosted by the rationing of petrol and diesel fuel in the post-Suez period, so that, in the absence of countervailing factors, a correspondingly steep decline might have been expected in the following year when this restriction on road haulage had been removed. On the other hand, the volume of production in manufacturing industry rose slightly between 1956-57 and 1957-58, whereas it was practically unchanged between 1957-58 and 1958-59. Other things being equal, this should have meant a smaller decline between 1956-57 and 1957-58 than in the following year. In the event, these two factors may have largely offset one another and reductions in charges have helped to stem the loss of traffic by the railways. To determine if this has been the case it is necessary to look at general merchandise carryings in recent years in more detail.

TABLE 2—TONNAGE OF GENERAL MERCHANDISE CARRIED BY BRITISH RAILWAYS
('000 tons)

4-weekly periods	*1956*	*1957*	*1958*	*1959*	*Percentage change* *1957 on 1956*	*1958 on 1957*	*1959 on 1958*
1	3,344	3,596	2,911	2,642	+ 7.5	−19.0	− 9.2
2	3,301	3,600	3,047	2,909	+ 9.1	−15.4	− 4.5
3	3,491	3,579	3,003	2,943	+ 2.5	−16.1	− 2.0
4	3,312	3,264	2,870	2,682	− 1.4	−12.1	− 6.5
5	3,323	3,240	3,006	2,870	− 2.5	− 7.2	− 4.5
6	3,153	3,128	2,728	2,722	− 0.8	−12.8	− 0.2
7	3,115	3,067	2,751	2,806	− 1.5	−10.3	+ 2.0
8	2,610	2,585	2,308	2,435	− 1.0	−10.7	+ 5.5
9	3,051	2,962	2,546	2,693	− 2.9	−14.0	+ 5.8
10	3,352	3,160	2,727	3,041	− 5.7	−13.7	+11.5
11	3,415	3,227	2,898	3,202	− 5.5	−10.2	+10.5
12	3,581	3,275	3,010		− 8.5	− 8.1	
13	3,293	2,807	2,681		−14.8	− 4.5	

Table 2, which is based on the four-weekly "Transport Statistics" published by the British Transport Commission, compares the tonnage carried in each of the four-weekly periods from January 1957 with that carried in the same period of the preceding year. It will be seen that in period 7 of 1959 British Railways' merchandise traffic was, for the first time for more than two years (much longer if the abnormal post-Suez period is excluded), greater than in the same period of the preceding year. In subsequent periods traffic has been consistently greater than a year before and the percentage gain has tended to increase.

During the period in which these gains have been made the railways have clearly been making substantial reductions in rates. Table 3 compares the tonnage of, and revenue from, merchandise and livestock traffic (separate revenue figures for merchandise are not available, but livestock traffic is in any case not very important, accounting for little more than 1 per cent of the combined tonnage and revenue) in 1958 and 1959. In periods 7 to 9, with the tonnage carried in 1959 greater than in 1958, the revenue was smaller; in periods 10 and 11 with the tonnage carried in 1959 over 10 per cent higher than in 1958 revenue was practically unchanged.

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TABLE 3—BRITISH RAILWAYS CARRYINGS OF GENERAL MERCHANDISE AND LIVESTOCK

4-weekly periods	*Tonnage ('000 tons)*		*Revenue (£'000)*		*Percentage change 1959 on 1958*	
	1958	*1959*	*1958*	*1959*	*Tonnage*	*Revenue*
1	2,951	2,670	8,158	7,085	− 9.5	−13.2
2	3,091	2,939	8,749	7,808	− 4.9	−10.8
3	3,050	2,978	8,598	7,805	− 2.4	− 9.2
4	2,912	2,719	7,951	7,127	− 6.6	−10.4
5	3,047	2,900	8,510	7,708	− 4.8	− 9.4
6	2,770	2,745	7,644	7,360	− 0.9	− 3.7
7	2,786	2,824	7,952	7,404	+ 1.4	− 6.9
8	2,339	2,453	6,600	6,387	+ 4.9	− 3.2
9	2,585	2,719	7,251	7,087	+ 5.2	− 2.3
10	2,773	3,074	7,896	7,895	+10.9	....
11	2,943	3,246	8,316	8,502	+10.3	+ 2.2
12	n.a.	n.a.	8,404	8,673	n.a.	+ 3.2

n.a.—Not available.

In the second half of 1959 industrial production was substantially higher than in 1958 (e.g. in September the index for manufacturing industry was 10 per cent higher than in September 1958). But the significant fact is that railway carryings of general merchandise have risen by a similar proportion. In the past the railways' merchandise traffic has fallen despite an increase in industrial production. Their attempts to attract and retain traffic by competitive charging and improved services are, apparently, achieving a substantial measure of success.

Summaries and Extracts from Studies of the French Railways

by

R. FORTIER

OTTAWA 1960

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Summaries and Extracts from Studies of the French Railways

Preface

Extensive damage to the railways of France during the Second World War made it necessary to rebuild a major part of the rail system in that country. This reconstruction programme provided an opportunity to modify railway facilities in accordance with the changes in transport conditions and to adopt modern innovations in technical operations and pricing practices. This unique experience of rapid renovation of facilities, techniques and rate-making could be expected to yield fruitful information for an appraisal of railway transportation problems in Canada. It was with this objective that the following report was prepared for the Royal Commission on Transportation. Permission of the publishers to summarize and quote the reports herein referred to is gratefully acknowledged.

Nationalization and Organization

Continuing deficits of the French railway companies in the nineteen-thirties led to nationalization which came about after the general election in 1936. The progressive intervention of the state, up to the time of nationalization, is described in the following chronological summary.

Early Period of Railroad Building

The state granted concessions to private companies for building and operating railways. Agreements with the companies covered the limitation of the area of operations, the financial responsibility of the state and railway companies, and the remuneration the companies were to receive.

The state purchased the land to be used for railway lines and paid the cost of establishing the basic facilities.

The first railway was organized in 1842. Others followed. From 1852 to 1859, under a reform programme, the number of companies with railway concessions was reduced from 26 to 6 and concessions were granted for a period of 99 years.

1859 and 1883

The state granted new agreements in 1859 which guaranteed bond issues on new lines; in 1883, the state guaranteed minimum dividends on companies' shares and granted loans to cover deficits on new lines.

1908

The state purchased one of the six concessionary companies.

1914-1919

During the war, the state took over the operation of the railways. After the war, the state gained ownership of the Alsace-Lorraine Railway.

1921

In order to improve railway administration, a Management Committee and a Superior Council of Railways were created by the state to co-ordinate operations, rates and financing for existing railways. Company and state representatives were included in both groups.

A common fund was established and deficits on certain lines were to be covered by revenues from companies operating with a surplus. General deficits were to be covered by loans from the state and reimbursed by modifications or increases in rates.

1933

State representation in the bodies created in 1921 was enlarged. But rate revisions had failed to cover the increasing annual deficits.

1936-1937

Deficits amounted to 21,776 million francs in 1936 and to 26,386 million francs in 1937.

Nationalization

After studying several possible solutions to the railway problem, a financial act was passed by the French Chamber on December 31, 1936, authorizing a complete reorganization of the existing railway system which was to be integrated in a co-ordinated public transport service.

On June 30, 1937, an act was passed granting the French Government the necessary power to ensure the financial stability of the French railways.

Two Orders in Council, issued in August, 1937, established the new rules governing the financial status of the railways.

The first Order pertained to the unification of the railways and the second to the co-ordination of railway and other forms of transportation. The unification approach was in effect nationalization.

The Order in Council on unification provided for the grouping of the existing seven railways, five of which were privately operated and two state owned, into one enterprise.

Under the terms of this Order in Council, a limited company was established to operate and if necessary to build railways. A subsequent Order in Council, proclaimed on December 31, 1937, gave the new body, known as "La Société nationale des chemins de fer français" or SNCF, the right to retain, for the next 45 years, all concessions granted to the existing five railway companies. All railway assets, except the private property of the companies, were transferred to the new company.

The company's new capital included in part the assets of the two state railways, the rights retained from state contributions to the other railways and all loans made by the state to the common fund established in 1921. Those assets represented 51 per cent of the total capital. The remaining 49 per cent of the capital included the assets of the five other railways to be retained by the former administrations until the end of 1955, and thereafter, by their shareholders until the end of the concession (1982).

Organization

The SNCF as indicated above is a mixed ownership company, that is, the state owns 51 per cent of the capital and the remainder is in the hands of the shareholders of the former concessionary companies. It operates under the Companies' Act of 1867 and various state controls.

The main body of the SNCF is the Board of Directors. The Board, through the President, is responsible for the general and financial organization, and through the Director for the technical direction.

The technical direction is decentralized on a regional basis. The country is divided in six regions and each region has the responsibility for three departments: traffic, rolling stock and motive power, and civil engineering. Each department is administered by districts.

State control in this mixed ownership company is apparent at all levels. The Board of Directors is composed of 21 members: 10 civil servants from the main departments of the government, including the President; five representatives from the shareholders of the former companies; five state-appointed representatives from the organization and one government agent, the General Director of Railway and Transport of the Department of Public Works.

Technical and administrative controls are supervised very closely by specialized branches of the Department of Public Works.

Financial controls come under the jurisdiction of the Control Commission of Railway Contracts of the Department of Public Works for contracts of major importance and of a Permanent Mission of Financial Control with regard to works, materials, pay, superannuation, rates and transport co-ordination.

The Accounting Commission representing the shareholders and the Accounting Commission of Verification of the Departments of Finance and Public Works, and various courts also have some control over the financial activities, through their year-end review.

Government Financial Contribution

Agreement and Order in Council of 1937

The railway reform stipulated with respect to the financial operations of the new company that, in principle, expenditures must be balanced by an automatic adjustment in rates. The financial sections of the Order in Council are as follows:

(1) the company is entitled to a compensating indemnity if the Department of Transport refuses to permit a rate increase and the money for the indemnity is to be voted by Parliament. The amount of the indemnity is to be equal to the amount expected from the proposed rate increase;

(2) the company is also entitled to a similar indemnity when it is ordered to reduce rates by the Department of Transport, and the money covering the indemnity is to be voted by Parliament;

(3) the company is entitled to payments based on average costs for services rendered yearly to the Post Office;

(4) to cover annual deficits, if any, reimbursable capital loans (called equilibrium subsidies) are made to the company by the state (The loans bear interest and up to 1949 were reimbursable in the following fiscal year.);

(5) in case of a large surplus, the agreement provides for its use for payments on current loans made by the state, for establishing a capital investment fund and a reserve fund and for payments on loans made by the state under the Agreement of 1921.

Under this financial system, the company showed a deficit in 1938, a surplus from 1939 to 1943, and a deficit again from 1944 to 1951.

Codicil of 1952

The financial obligations of the company were modified by a codicil in 1952:

(1) the company was relieved of its obligation to balance expenditures only by action on rates;

(2) the state began participating in certain expenditures.

While compensating indemnities and equilibrium subsidies remain, the state now assumes 60 per cent of the maintenance and renewal expenditures for trackage, tunnels, bridges, culverts and safety devices, and 50 per cent of the expenditures on railway crossing signals for highways.

The company, in return, pays a rent for the use of the services amounting to 5 per cent of its gross receipts.

The financial results of the company's operations are available for certain years after 1951. They show a deficit for 1952 and 1953 and also for 1957 and 1958.

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Cost Price Principle[1]

"The legal principle of equality of transportation over the same distance, irrespective of the line used has always been the basis of the rate structure in Europe. That principle can be defined as the choice of the shortest distance between the destination and the point of shipment, for the purpose of establishing a rate, without taking into account the route actually used or the operating possibilities of the shortest distance.

[1]Extracts translated from a paper by R. Hutter, "La différenciation des tarifs d'après le prix de revient", extrait de "l'Europe Unie par le Rail", édition 1958-1959, pp. 1, 2, SNCF, Paris.

"From this principle most of the prices for transportation are calculated by applying to this shortest distance the uniform kilometric schedule corresponding to the commodity; while railway rates are differentiated according to the nature of the commodities, even if that nature does not affect average cost, they compensate unprofitable items with profitable items and avoid differences in cost prices by averaging.

"The acceptance of this principle is based in part on practical reasons: the schedule system based on the shortest distance is one of the most simple and makes it possible to group all rates supervised by the government in one handy book. It also has a theoretical justification: the compensation it establishes between regions which are readily accessible and regions which are difficult to service, and generally relatively poor in terms of the general economy.

"A fundamental idea of 19th century economic thinking was that railway rates were a compensation fund for the economy as a whole which was not limited to the equalization of profitable and unprofitable services; it was expressed also in the *ad valorem* theory of ratemaking which wrongly attributed to commodities the role of economic agents, charging high-value commodities with the low rates granted to low-value commodities and in the grading which attempted to compensate for the remoteness of certain regions by lowering long distance rates. In the 19th century, the wide acceptance by the railways of such concepts was based on the following:

(1) the monopoly they exercised along with the inelasticity of transportation permitted them to equalize or differentiate without directly harming their traffic;

(2) the assistance given by high rate traffic to low rate traffic permitted to develop the latter beyond the optimum and, as a consequence, to increase total traffic and total receipts;

(3) since the accounting system of that period did not permit systematic calculation of the cost of each haul, the biases resulting from the equalization were not well known and there was no objective basis to warrant a rate differentiation;

(4) individual cases where uniform rating was harmful to traffic, such as for lines parallel to waterways, were solved by special reduced rates readily approved by governments.

"Road competition (in the thirties) which developed without being submitted to the principle of rate equalization, took advantage of the situation by attacking first the important services with a good grade, where its technical cost was the lowest and return freight was abundant while relatively neglecting regions not easily accessible.

"Without being of the same importance as the "creaming" of high-value traffic because of the *ad valorem* rate theory, the "creaming" of important services was very apparent and happening as it did during a recession period, it was very much felt.

"To analyse the situation railway administrations settled down to a systematic calculation of cost prices."

Value of Transportation and Cost Prices[1]

"An agreement between the transport firm and the customer, *i.e.*, a shipper of commodities or a passenger, must be reached before transportation takes place. To that effect, there will be haggling between them. The transport firm will try to obtain a price as high as possible. In granting concessions to the customer, it will not be able to go below the average total cost; if it accepted a lower price, it would operate at a loss. The customer, on the other hand, will try to get a price as low as possible, but in any case, he can only accept a price for transportation which is below a certain limit; if the price of transport were above that limit, he would not agree to ship; that limit represents for him the use value of transportation, or in simple words: the value of transportation.

"In order to reach an agreement and if transportation is to take place, average cost must be below the value of transportation; the price of transportation will be fixed between those two limits; the spread between the price of transportation and average cost represents the carrier's profit; the spread between the value of transportation and the agreed price is an indirect profit for the customer: it is the portion he retains of the amount he would have been willing to pay for the movement to take place.

"For railway transportation, things do not work out exactly that way: rates are published in advance and the customer chooses from the schedule of existing rates the one he wishes to see applied to his particular case.

"Properly speaking there is no haggling between the railway and the customer: if he ships at all, the latter accepts the printed rates. The contract takes the form of an accepted contract. It sometimes happens, mostly when special rates are involved, that prices are established by the railway after discussion with the interested manufacturers or traders. We have then the normal action of supply and demand.

"It can be seen, in the establishment of the rate level, that average cost and value of transportation play a fundamental role; before we examine on what principles the rates are fixed between those two limits, we will attempt to define value and cost price of transportation."

[1]Extracts translated from "l'Exploitation commerciale des chemins de fer français", by R. Bourgeois, édition Léon Eyrolles, Paris, 1955, pp. 45-61.

A. *Value of Transportation*

"For each movement made under given conditions of speed, safety and comfort, there is a value of transportation such that, if the railway asks for too high a price, shipment will not take place, because there will be no traveller or shipper.

"What are the factors underlying the value of transportation? We will answer the question by looking at the case for commodities. . .

"For freight, it can be said that the value of transportation is represented by the increase in the market price of the commodity caused by moving it from one place to another, which is the difference between the price of the commodity at the destination and its price at the point of shipment.

"If, for example, a commodity is worth 8,000 francs in A and its sale in B brings net receipts of 9,000 francs, its transportation from A to B increases the value of the commodity by 1,000 francs; if the transportation between A and B costs 300 francs, a trader who wishes to ship that commodity to B for a sale will not hesitate to go through with a transaction bringing a net profit of 700 francs; if, on the other hand, the price of transportation is only a little higher than 1,000 francs, no trader will desire a shipment bringing a loss; 1,000 francs, the difference between the selling price in B and the selling price in A, really represents the limit which the cost of shipping cannot exceed if there is to be a movement of the commodity; it is the value of transportation. A number of factors affect the value of transportation.

"In the first place, with economic conditions changing as the shipment gets farther away from the shipping point, the difference between the price of the commodity at the shipping point and its value at its destination must vary also with distance; it is evident that distance affects the value of transportation.

"But the way changes occur varies according to cases. If the value of transportation does increase with distance, it is not so in all cases; for example, the value of transportation of a ton of coal might be higher for an area located 150 km from the mine and far away from any other coal mine, than for an area located at 800 km but receiving shipments of competitive coal from another source at a lower price. The classical example of agricultural products can be used to show that prices vary a great deal according to meridians and very little according to parallels; conditions affecting growth do present in general greater fluctuations in the first case than in the second.

"When the value of transportation increases with distance, the increase is not generally proportional and, in most cases, it grows less rapidly than distance; this explains the practicality and interest in graded schedules, which are used almost exclusively for commodity traffic.

"The value of the commodity is another important variable which affects the value of transportation; in general, rates which can support on the same route different commodities are highest for the most expensive commodities; it can be seen that, between two distant areas, a shipment of silk weighing 100 kg valued between 1 and 2 million can support more easily a price spread of 2,200 francs than a ton of fertilizer valued at 20,000 francs. But this rule is far from being absolute: a grain crop harvested everywhere, such as wheat, will not show, even between two distant areas, significant price spreads and will require for transportation a rate lower than the one applied to sea salt and talc, which have a much lower value at the production point, but for which the distribution according to the location of the mining areas calls for transportation over great distances to areas which are in need of them.

"Finally, the use to which a commodity is put can also affect the value of transportation: this applies to lime, for example, which can be used either for building or land improvement. It is easily understood that the building trade will agree to a higher price for lime—a material of primary importance—than the farmer who, strictly speaking, can forego its use as he did before.

"But to those many sources of variations of the value of transportation originating in the difference between the values of a commodity at the point of shipment and at its destination, others must be added that have a considerable influence depending upon the transportation conditions: speed, regularity, convenience, etc., in summary, the quality of transportation.

"Speed of transportation, by shortening the period the commodity is moving, permits inventory reductions for the receivers and consequently reductions in frozen assets; it speeds up account settlements between shipper and receiver and tends to reduce the time during which funds are tied up; it is the only way in which urgent needs can be satisfied. Some shipments would not even take place if they were not carried with sufficient speed; such is the case with perishable products: sea food, meat, fresh fruits and vegetables, for which the value is based on the speed with which they are moved. It can easily be seen that for certain commodities the value of a transport increases in proportion to the speed of the transportation.

"The same remarks can be made on the regularity with which shipments are made and on the financial advantages to industry and trade; in that regard, railways, because of their transportation obligations, must accept commodities for delivery and route them according to schedules fixed in advance and known to the public, thus ensuring a regularity which constitutes one of the main factors of the value of rail transportation.

"The convenience of timetables, the accessibility of railway stations which permit trucks to gain time on delivery, the reduced risk of damages

in classification yards which reduces packing costs and eliminates lawsuits, in summary, all the technical improvements which help improve the quality of transportation, increase the value of transportation."

B. *Cost Prices*

(a) *General Remarks on Cost Prices*

"Before discussing cost prices for the railways, it is essential to review briefly some of the fundamentals of cost prices in general.

"The cost price of an article or a commodity is what that article or commodity costs to the one who sells it.

"The application of that definition is easy when the trader sells—or the product manufacturer produces—only one category of goods; a manufacturer who makes one type of shoe will calculate the cost price of a pair of shoes coming out of his factory by dividing all the expenditures made during a given period by the number of pairs of shoes manufactured during the same period.

"The problem is more complex when more than one article is manufactured. If, for example, the manufacturer we speak of makes sandals and laced-boots, he will, to calculate the cost price of a pair of sandals and the cost price of a pair of laced-boots, divide all his expenditures in two parts, the first one relating to sandal manufacturing and the second one to laced-boot manufacturing.

"But if certain expenditures such as for labour, raw materials and machinery maintenance are easily attributable to one or the other product, certain general expenditures (management, general publicity, etc. . .) affect over-all production. Their distribution among the various products can be made according to several more or less arbitrary methods, and some hesitation is possible in choosing one rather than another.

"In the above example, the manufacturer may distribute the expenditures common to the manufacturing of sandals and laced-boots according to the number of pairs made in each group. But he may distribute them, for example, according to the value of the articles produced; if the value of laced-boots is much higher than the value of sandals, the second method of distribution gives sandals a lower cost price, and laced-boots a higher cost price than the first formula. It is possible to apply to the category which is the most easily sold a systematically higher share of the general expenditures, or most of them.

"One can imagine, even in the simplest of cases, many other methods of distribution for general expenditures between different products. It is clear that the number of possible formulas of distribution will increase according to the number of products for which a separate cost price must

be calculated. On the other hand, cost prices are influenced by the possibilities of distributing general expenditures to a degree which depends on the size of the expenditures. The arbitrary and uncertain nature of the cost price calculations is therefore increased in proportion to the variety of the products and the amount of the general expenditures.

"The cost price as we have defined it is calculated on the total expenditures of the firm; we will call it the total cost price or the complete cost price to distinguish it from another cost—the marginal cost price—which we will now consider.

"If we call the factory production P, and total expenditures D, it follows from the above that the total cost price is equal to $\frac{D.}{P}$

"If production varies from level P by a small quantity $\triangle$ P, expenditures will vary also, by the quantity $\triangle$ D, and we will call the marginal cost price $\frac{\triangle D}{\triangle P}$; or the variation in expenditure by unit of production.

"In ordinary terms, it represents the additional expenditures necessary to produce one additional unit or the savings made when production is reduced by one unit.

"With this, one can easily see that the value of the marginal cost price depends upon the level of production P from which it is calculated by comparison to the level of maximum production P, which a factory can reach with its facilities and which we will call level of full employment.

"If P is below P, the factory is underemployed; a small increase in production will bring an increase in a certain number of expenditures (for shoes: labour, leather consumption machinery wear, etc.) called variable expenditures, other expenditures remaining fixed (general expenditures, part of management expenditures, capital charges, etc.).

"If, on the contrary, the factory is in full employment, an increase in production will bring an increase not only in variable expenditures as in the previous case, but also in the ones which were fixed a moment ago: necessity to buy new machines, to enlarge buildings, to increase management, etc. The average marginal cost price is thus higher than when the factory is underemployed.

"The marginal cost price for full employment is defined as corresponding to increases in expenditures by unit of production when the factory is constantly in full employment, that is, its facilities are constantly adapted to production. It is to be noted, however, that, when production varies, expenditures cannot all be constantly adapted to production. For example, when production decreases, certain expenditures which can be immediately cut off (raw material, day to day labour) are reduced without

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delay in the same proportion; other expenditures which can be cut off gradually (machinery, contract labour) disappear only after a while. Other expenditures, finally, are inescapable and cannot disappear (financial charges, land). The result is that the progressive marginal cost price (case of a factory for which production increases constantly) is different from the regressive marginal cost price (case of a factory with decreasing production), the first being higher than the second.

"We assume before that $\triangle$ P is a relatively small increase in output. In practice, to calculate the marginal cost prices a substantial increase (or decrease) of P is generally assumed; the value of $\frac{\triangle D}{\triangle P}$ depends then upon the importance of $\triangle$ P.

"Without going into excessive details, it can be seen that the higher $\triangle$ P is, the greater will be the number of expenditure categories it will cause to rise. For example, coming back to the shoe factory, if we assume a factory underemployed, an output increase of a few pairs of shoes will not entail important variations in labour expenditures or supply (leather, thread, etc.). If the number of shoes added increases, it will become necessary to buy a new machine, the ratio $\frac{\triangle D}{\triangle P}$ will be greater; if $\triangle$ P increases more, the size of the factory will have to be enlarged, etc.

"It can be seen that looked at as the ratio of an increase (or decrease) in expenditures to an increase (or decrease) in output from a level of production P, the marginal cost price depends on the one hand on the level of output, and on the other hand on the variation envisaged by the calculations.

"This remark will be useful in the case of the railway.

"The selling price will be, in general, above the total cost price if the factory is to prosper. It can happen that for certain products it will be below cost price if, for others, it is above; it will be sufficient that on the average the selling price is at least equal to the total cost price.

"On the other hand, the selling price of a given product must never be below its marginal cost price because, then, the manufacturer would have to stop production, price receipts would fall short of production expenditures.

"Thus, between the selling price and the marginal cost price, there is always a differential which accounts for the gross primary profit representing the share of the general expenditures of the firm charged to the product concerned.

"In a depression, if the selling price cannot be increased to a level high enough to cover all expenditures, rather than closing the factory, it may be worthwhile to establish a selling price, on the average, at an inter-

mediary level between the marginal cost price and the total cost price so as to cover only a part of the inescapable expenditures. For example, a smaller return will be attributed to capital.

"It will be acceptable, under normal conditions, to base the selling price on the marginal cost price in a case where total expenditures are already covered by current production and a new order comes in; for this new production, the excess of the selling price over the marginal cost price will be a supplementary net profit. The marginal cost price, in such a case, is in fact the cost price of this additional production, and it is sometimes called: the additional cost price.

"In summary, receipts on the whole must cover total cost prices; but certain sales may be made at a lower price, between total cost prices and marginal cost prices, provided only that other sales are made at a price sufficiently higher for the average selling price to be at least equal to total cost prices.

"It is therefore most important to know the marginal cost price, which constitutes the limit below which the selling price must never go.

"All those remarks apply without modification to the railways; however, railways are different from other industries in some respects, which we will now consider."

(b) *Cost Prices for Railways*

"Railways sell a service, transportation, which is varied: passengers transported, tons transported (transport of persons and commodities), passenger kilometer, net ton-kilometer (transport of one passenger or of one ton of commodity over one kilometer, etc.).

"These services, called traffic services, are the ones for which it is useful to know the cost price. To that effect, it is often necessary to calculate beforehand the cost prices of other services called operating services.

"The latter are many and varied; they may be related, in effect, to all the operations carried on by the railway. Movement of trains, terminal operations, classification, etc. The most important for the purpose of cost price calculations are: the train-kilometer (movement of one train over one kilometer) and the gross ton-kilometer moved (GTKM, movement of one ton of train, engine excluded, over a distance of one kilometer).

"Before indicating the conditions under which those costs are used for commercial purposes, we should analyse, in a short theoretical study on the total cost price and the marginal cost price, the characteristics of those costs and the particulars of their calculations.

(i) *Total Cost Price*

"A given service may in general be produced under extremely variable conditions, which influence its total cost price,

depending upon the itinerary, the time of transportation and circumstances.

"The total cost price of a train-kilometer, or GTKM, depends upon many variables:

—the train category (fast, express, direct, omnibus)

—the train tonnage by itself (the price of a train-kilometer increases with the train tonnage, all other factors being equal; on the contrary, the price of one GTKM decreases as the train tonnage increases)

—the motive power

—the grade of the lines used (the total cost price of the train-kilometer and the GTKM is proportionate to the grade)

—the density of the line (the total cost price of a train-kilometer decreases as the traffic on the line used increases; expenditures independent from the traffic, applicable to the line, are divided by a greater number of services).

"The total cost price of a service may have very different values depending upon the conditions under which it is made. It is particularly important to emphasize this, because it determines, in a large measure, the railway rate structure. For example, in the most unfavourable cases (shipment of a carload at the lowest weight provided for in the tariff on a regular freight train serving a small low density line), the total cost price of a net ton-kilometer of goods may be more than 45 times the total cost price of a similar service performed under better conditions (mass transportation on a full train on a line with a good grade). We encounter here, for the first time, an essential characteristic of railway transportation, that is, the possibility of getting very low prices for mass transportation.

"Also, the total cost price of freight transportation depends to some extent on the nature of the freight. An indivisable quantity of great weight, necessitating the use of special transport equipment and special loading and unloading precautions, might cost more to transport than the same weight of a commodity loaded normally on an ordinary car; transportation of a commodity easily damaged, such as wine in tank-cars, is, weight being equal, more expensive than it would be for a less fragile commodity such as asphalt. Higher damage risks influence the total cost price of a transport, etc.

"Thus, it is not possible to find a formula covering all conditions under which a given service might be performed and the practice is to calculate for each service an average total cost price for a

given period over a certain number of given lines; for example, the average total cost price for the first class passenger-kilometer on all the lines of the SNCF, or for a train-kilometer for express trains, under steam traction, in a given area.

"In certain cases, the average cost of a well-defined movement may be needed. For example, one may wish to know the transportation cost price for a full train of minerals of a given tonnage between two given stations, or for a special daily train requested by a manufacturer to carry his workers from the factory to the city. It is called a particular cost price (as opposed to the average total cost price), the cost of a transport for which the characteristics are known.

(ii) *Marginal Cost Price*

"Before beginning, a remark must be made: the existing facilities of the railway are, in general, capable of absorbing much more traffic than is being done. In other words, the railway is underemployed and any traffic variations which might develop do not have the effect of moving it into full employment. Exceptional traffic peaks such as departures on holidays might move it towards a state of full employment as far as passenger facilities are concerned, but, at the same time, the facilities for moving commodities are far from being fully used.

"It follows, in practice, that marginal cost prices of full employment are unimportant for the railway operator and in most cases marginal cost prices of underemployment are taken into account. The marginal cost price of a service depends, as does its total cost price, on many variables, and, for the reasons given in the preceding paragraph, one must use in most cases average marginal cost prices or, in some cases, particular marginal cost prices.

"Most of the variables affecting the total cost price of a service (motive power, train tonnage, loadability per car, distance) affect also its marginal cost price, but the latter depends also on other factors. On the same line, traffic is seldom in perfect equilibrium, and there is, in general, a one-way movement of empty cars on their way to be loaded; it is evident that their return with freight adds very little cost; on the return trip the marginal cost price of the freight is thus very small.

"Sometimes one might be justified in including capital charges in marginal cost prices; this is the case of new traffic requiring basic installations, such as doubling a line. But, if these capital

charges must be taken into account, before the expected traffic is in operation when the railway studies future productivity, the situation is no longer the same when basic installations are completed. From that moment, of course, capital charges acquired take a definite character; they would subsist if the traffic disappeared and they can no longer appear in the calculations.

"The traffic increase, which enters into the calculations of the marginal cost price of a given service, may also cause wide variations in that price. For a small increase, a few passengers, for example, the marginal cost price of the passenger-kilometer is insignificant, because transportation expenditures are not affected. However, in the case of a number of passengers large enough to require the use of a full car, the marginal cost price is increased by the costs of car upkeep and depreciation, by handling at the arrival and departure stations, and by the added costs in terms of motive power. If the supplementary traffic is large enough to call for the movement of a full train, the marginal cost price will include, in addition to the costs already mentioned, those related to locomotive upkeep and depreciation, to personnel directing and accompanying the train, to fuel consumption, etc. So, during periods of departure on holidays, the costs of doubling regular trains determines the added marginal cost price.

"A similar reasoning applies to freight traffic. Other things being equal, when the volume of traffic on which the calculations of the average cost price of a given service are based . . . increases, the marginal cost price of the service increases.

"This is a very important factor and we will refer to it when speaking of competition between forms of transportation. It shows that if a small amount of traffic going over the railway line disappears, the savings made by the railway are small and do not compensate, in general, for losses made by the reduction in receipts, because the marginal cost price of the traffic which is gone does not include the important operating charges which exist on account of the remaining traffic and which would disappear if the line could be abandoned.

"The ratio between the average marginal cost price and the average total cost price varies little with distance or weight of the shipment (small parcels, retail, carloads, full trains). It is of the order of 70 per cent.

"On the other hand, the ratio between a particular marginal cost price and the corresponding total cost price may vary extremely, depending upon the fact that the railway has or has not part or all of the personnel and material required to move the shipments involved.

"For transporting considerable additional quantities of commodities by full trains, for which the total cost price per net ton-kilometer is very low, the marginal cost price might be in the order of 80 per cent of the total cost price, if the situation of the equipment is such that all interest and depreciation charges on rolling stock are taken into account.

"On the other hand, in the case of carload transportation on a line where trains are not fully loaded, the marginal cost price might only be in the order of 25 or 30 per cent of the total cost price.

"In most actual cases, this ratio is maintained at a relatively low level, which is below 50 per cent. This is an essential characteristic of railway operation, which derives from fixed charges and we emphasize it because it influences in a large extent the railway rate level and the solutions that could be advocated to solve the problem of road competition.

"Also, the differential between the marginal cost price and the total cost price is particularly important for the transport firms which give regular service on fixed schedules: on a regular maritime line with a regular weekly departure, as long as the boat is not fully loaded and the volume of traffic does not call for doubling the services, the marginal cost of shipment is relatively low and corresponds only to the increased fuel expenditures resulting from the fact that the boat moves loaded and not empty, because the boat has to make the trip; the same applies to the railway for services with fixed schedules as for passenger traffic and for certain regular express or freight trains. It is the reverse for the tramp which carries full loads on demand, or for the road shipper, who makes shipments on demand; the marginal cost price of a shipment is then little different from the total cost price.

"For road transportation, the differential between the marginal cost price and the total cost price of transportation is relatively low. It is again appreciable for the regular passenger services by bus because of their regularity; however, even for those services the differential between prices is not very large because of the low capacity of the vehicles and the obligation of the

operator to put on the road supplementary services as soon as traffic is a little above average. But, in connection with non-scheduled transportation services, *i.e.,* the majority of the public road carriers or inland waterway transportation, the greatest part of the firm expenditures are represented by traction expenditures (drivers, fuel, upkeep and depreciation of equipment) which represent the marginal cost price.

"To understand this better, let us compare, under the economic conditions of 1954, the cost price of a net ton-kilometer for a 15-ton truck travelling over a long distance and the corresponding cost for a carload by railway under the same conditions; we see that the marginal cost price represents 85 per cent of the total cost price for the road and only 50 per cent for the rail.

"From this we have the following main ideas:

"The cost prices of the two most used traffic services in the trade (passenger-kilometer and net ton-kilometer) are values which are extremely varied: in practice, for each particular haul considered by itself, there are different values for those costs.

"On the other hand, three essential characteristics of railway cost prices have the greatest influence on its commercial policy:

1. the low rate for total cost prices which the railway can achieve for mass transportation allows it to set very low rates in this field when necessary;
2. the significant spread, in most cases, between marginal cost prices and total cost prices allows highly differentiated rates;
3. the variation of the marginal cost price according to traffic volume taken into account in the calculations demonstrates that the disappearance of a given traffic gives the railway important savings only if it calls for elimination of equipment (such as abandoning a line).

(iii) *Calculations of Cost Prices for the Railway*

"It is understandable from what has been said that calculating railway cost prices is difficult and should, in most cases, be left to specialists.

"The first difficulty stems from the numerous services for which cost prices must be calculated; we have seen that the complexity of the calculations increases for a firm with a number of product categories for which a separate cost price must be calculated. For instance, there are 44 categories of trains for which the SNCF calculates average total cost prices.

"Another difficulty in the calculations of the total cost prices for the railway pertains to the relatively high common costs to be distributed according to *a priori* formulas between the various services.

"If, to use a simple example, one calculates, on the one hand, the general average cost price of a passenger train-kilometer and on the other hand, the general average cost price of a freight train-kilometer for the SNCF, for a given period, all the expenditures of the period must be distributed between the passenger traffic and the freight traffic.

"Certain expenditures can be distributed immediately and easily between the two traffics; this is the case, for example, for the expenditures for the crews operating the trains, for motive power, for the upkeep of rolling stock, for certain station services, and for rolling stock charges. But a considerable amount of expenditures remains. They cannot be attributed *a priori* to either traffic; this is the case for general expenditures, general station expenditures, expenditures for common installations and building charges of the railway which are common to both traffics.

"In 1952, expenditures common to both traffics amounted to 37.6 per cent of the total expenditures of the SNCF, expenditures immediately attributable to each traffic represented 62.4 per cent of the total.

"For the distribution of joint costs between the various categories of services, the rules used differ according to the kind of expenditures involved. It is not possible to indicate here the rules used in all cases. We will give only one example: in the case studied above regarding the calculations of the cost price of a passenger train-kilometer and freight train-kilometer for the SNCF, the general station expenditures (management, office, etc. . .) and the expenditures related to the movement are distributed *pro rata* to the personnel expenditures directly attached to each category of train, that is, the personnel used to sell and check tickets, to register shipment, to handle commodities, . . .

"As for marginal cost prices, we never use, as indicated before, the marginal cost with full employment.

"The average marginal cost price is calculated for a significant traffic increase, taking into account personnel and equipment charges; the composition of personnel and equipment has to be adapted to the new traffic level, but general expenditures and

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fixed equipment charges are excluded, since no equipment is supposed to be necessary to face the increased traffic.

"For example, as far as freight traffic is concerned, we include in the calculations of the marginal cost price of a net ton-kilometer the direct expenditures for station employees, expenditures related to the train movement and to transportation and the financial charges for equipment and we exclude the general expenditures, the station general expenditures, the supervision expenditures, the upkeep and renewal expenditures for the tracks, the civil engineering expenditures and the financial charges of construction.

"The general average cost price on SNCF lines for a net ton-kilometer moved in carload is six francs and the average marginal cost price is only 4.3 francs or 72 per cent of the total cost price.

"For passenger traffic, the general average cost price of a fast and express train-kilometer is 1,200 francs and the average marginal cost price is 700 francs, or only 58 per cent.

"The marginal cost price of a car-kilometer on a fast and express train, corresponding to the expenditures in relation to the addition of a car to an existing train, that is, without any addition in the distance moved, is only 30 per cent of the total cost price.

(iv) *Use of Cost Prices*

"Knowing the cost prices is essential for the railway operator in many circumstances, particularly for commercial requirements.

"Studies relating to changes in the rate structure such as those required to improve routing of freight and the grouping policy, cannot be properly undertaken unless they are based on cost prices.

"Special mention must be made, in that respect, of the tariff reforms of March 17, 1947, and August 1, 1951, which were two milestones for the increasing role played by cost prices (average total cost prices and average marginal cost prices) in determining rates for freight transportation.

"The same remarks can be made with regard to rates being influenced by the technical improvement of motive power (electrification, dieselization) of equipment (building of open cars of a greater capacity, weight reduction in cars of great capacity, etc.). Rate decreases granted to shippers stem in this case from lower cost prices from technological advance.

"A clause in the 1937 Agreement provides for reimbursing at cost price transportation charges attributable to the Post Office; clause 18 of the same Agreement stipulates that the SNCF must propose rate increases if the expected receipts seem insufficient, taking into account the market for transportation, and to prepare the appropriate rate measures, it must compile for different traffic categories, cost prices and receipts.

"Knowing the particular marginal cost prices is equally important in many cases where a decrease in transportation prices is requested by a firm, either for new traffic which would not develop without a sufficiently low rate or for traffic attracted to another form of transportation which the railway would like to retain; the marginal cost price will give, in such a case, the limit below which the railway will not go in its concessions.

"In the same manner, cost prices play an essential role in the establishment of special rates to solve particular problems.

"Finally, numerous studies which may have important consequences for the general policy of the railway require information on cost prices, *i.e.*, balance sheets for a certain line, profits shown by a new line, normalization of a branch line, comparison between the cost of moving by railway or by some other proposed method (canal, pipeline, etc.).

"It can be seen that the knowledge of cost prices plays an essential role in the operation of a modern railway and, in many cases, no sound decision can be taken without them.

"One of the first duties of the SNCF was, in the early days, to create a special service to study and calculate its cost prices; the documents assembled by that service are, for the railway operator, an indispensable tool."

SNCF Methods of Calculations [1]

The cost price calculations for a railway are different from those used by other industries. The very large number of movements on a railway involve many variables and different costing.

A. *Methods*

The objectives of the methods adopted by the SNCF, which are those of the Union Internationale des Chemins de Fer, are as follows:

(i) to determine the general average total cost price for different categories of traffic and trains;

[1] Summary from "Le calcul des prix de revient à la SNCF", SNCF, Paris, 26 pages.

(ii) to permit calculations, on demand, of any cost price for particular movements.

B. *Expenditures*

Expenditures are grouped under ten chapters and 197 items. The chapter headings are: charges as employer—general administration and general expenditures—operating expenditures—equipment and motive powers—trackage and buildings—electric power—marine equipment—cost prices of assignment and services for others—renewal charges—financial charges and others. Many items are subdivided into paragraphs:

(i) personnel

(ii) business and miscellaneous

(iii) materials

(iv) miscellaneous expenditures

(v) distributed expenditures.

The accounting system of the SNCF supplies most of the information. Corrections are made in real expenditures to normalize programmes of renewal of equipment and trackage over the years.

The calculations are made for 71 train categories.

C. *Distribution of Expenditures*

Cost price calculations are made by regions. Expenditures which are not directly attributable, such as general administration expenditures and other indirect charges, are distributed by regions. The expenditures are then attributed, item by item, to the various services and train categories. Three methods are used:

(i) 13 per cent of the charges are distributed by direct accounting procedures, *i.e.*, repairs and maintenance of equipment used in suburbs;

(ii) 65 per cent of the charges are distributed according to statistical methods or surveys;

1. crew costs are distributed by form of motive power, according to the distance covered by each category of train, the average distance covered by the crews and the average annual salary of each crew;
2. station expenditures: survey method;
3. trackage maintenance and expenditures: according to GTKM;

(iii) 22 per cent of the charges are distributed according to accounting key formulas, *i.e.*, general expenditures.

D. *Variation of Cost Prices According to Certain Parameters*

The two chosen parameters are the load and the distance. Other parameters are constant and equal to their average value, that is the various hauls are assumed to be distributed in the same manner over the railway lines.

E. *Factors of Correction*

Investigations are carried out from time to time to find out how P, the real general average cost price of a given category of traffic, differs from Px, the general average cost price corresponding to the various average cost curves obtained from P and to the traffic distribution by section of distance and by load. It is in the order of 2 to 3 per cent.

F. *Use of Calculations*

The calculations are used:

(i) to establish the balance sheet of operations;

(ii) to adjust rates;
more and more the rate structure is modified according to marginal costs, the only way to ensure fair competition between the various forms of transportation;

(iii) to calculate particular cost prices.

Rates[1]

Generalities on Traffic and Rates for Commodities – SNCF

"The SNCF carries freight of all kinds over a very ramified network of about 39,000 km. Its annual traffic is now of the order of:

210 million taxed tons

53 billion taxed ton-kilometers (or about $\frac{2}{3}$ of the total French kilometer traffic)

These movements are assigned different rates according to the transportation method (consignments, shipments by carload or by trainload) and according to speed.

"(a) Consignments (parcel post and small parcels) account for a large number of shipments (more than 60 million parcels a year), but represent only 2 per cent of the total tonnage.

[1] Extracts translated from: "Notice sur le trafic et la tarification des transports de marchandises", SNCF, Paris, 1960, 12 pages.

Shipment is handled by the railway; home delivery is made in all relatively important localities [5,000 or more]. Transportation by freight car represents annually about 6 million shipments and 13 million loaded cars, accounting for 98 per cent of the traffic.

"The SNCF makes available to shippers three types of cars (box, open top and flat), and a few special types. Shippers are free also to use their own cars under certain conditions (about $\frac{2}{5}$ of the traffic by car for coal, minerals and refrigerated commodities are made that way).

"(b) The rates provide for three types of speed:

(i) express trains (passenger trains) which apply only to consignment shipments on demand;

(ii) fast trains (great speed) which apply automatically to consignments and to shipments by car affected by special rates (general per car rates, grouping, perishable commodities) or, on demand, for shipments mostly made by ordinary trains; those shipments are thus rated according to the general rates;

(iii) ordinary trains (low speed), which apply to all other shipments.

"When shipments are made under normal operating conditions (that is by ordinary cars from the yard and moved from one station to the other by trains under the general plan of movement) they are rated as follows:

general rates

numbered rates 1 to 25 and 100

"(a) The *general rates* are made up of four chapters:

(i) Parcels

(ii) Small consignments

(iii) General rates by car

(iv) Express shipments.

"(b) The *numbered rates 1 to 25* are the common rates for shipments by car. Each rate includes a group of related commodities according to kind such as:

rate 1: Livestock

rate 6: Beverages

rate 7: Mineral fuels

rate 18: Chemical products, etc.

Their presentation is identical and includes:

(i) Chapter 1, specifying the commodities and the applicable rates from station to station;

(ii) various special chapters, applicable to certain designated commodities and under given conditions such as:

designated train services;
quality (quarries, factories) of shippers and receivers;
guarantee of traffic (fidelity pledge and subscription formulas).

Rate number 100 is concerned with the grouping of commodities delivered by middle-men in the field of transportation.

"An important section of the traffic is made under special operating conditions. For those shipments the rates are called rates subject *to regulations* (numbered 101 and over) and each one relates to a definite mode of operation.

Rate No. 101—Indivisible shipments and goods of exceptional size

Rate No. 102—Private sidings

Rate No. 103—Full trains

Rate No. 104—Private cars, etc.

"The stipulations of those rates are added to or modify the other rates. They might be related to a third party not related to shipping or receiving (such as the owner of a private car).

"Traffic exchange with foreign countries accounts for one third of the total traffic; 30 per cent of the tonnage at SNCF rates on the French routing—70 per cent, at prices and direct international rate conditions according to the foreign railway administrations interested.

"Without going into the details, we will now give a few general principles on rate calculations for shipments by freight car.

"(a) As a general rule, the rate is based on weight, at schedule prices for an effective ton, according to distance (schedules consist of 110 distance levels).

"(b) The rate gives for each commodity, for Chapter I as well as for the special chapters, one or several schedules, applicable for a minimum load.

The price applicable is the lowest resulting from the conditions under which the shipment is made.

"(c) The distance from point A to point B is (except as stated otherwise) the shortest of the various routes joining A and B.

The distance for each of the 6,800 locations to each other is given in the Distance Document. It may be noted that:

(i) The real routing distance is often very much above the distance for which the rate is given (on the average, 24 per cent above for shipments by ordinary train).

(ii) Occasionally, the distances (established from the services operated in 1941) used are calculated over parts of lines now closed as far as railway operations are concerned.

"The pricing of small shipments is based on real weight and shortest distance: the schedules show prices by 100 kg and have 26 levels.

"The pricing of parcels is made according to fixed rate by parcel; prices vary according to weight and zones of distance designated in the rates.

"The ratemaking for shipments by car is extremely varied . . ."

SNCF Ratemaking Policy

"(i) to limit rates at the top to the average price level which cannot be exceeded because of competition;

(ii) to limit rates at the bottom to the direct expenditures involved in the carrying out of each shipment (marginal cost);

(iii) to adapt staggering of rates to marginal costs.

"In general, experience has shown that rates can still remain very appreciably differentiated according to the value and the economic role of commodities, either for level rates or rates graded for distance. However, the difference between the highest and the lowest rates is much less than in the past.

Up to now, two reforms affected profoundly the rate evolution: the 1947 reform and the 1951 reform.

"The 1947 reform established the framework of modern ratemaking.

"For shipments by car, it has shown in the rates (per effective ton and according to distance):

(i) the considerable influence of the load on cost prices, which vary roughly, per ton, from one (per 20 ton car) to eight (per two ton car); the loading capability of various commodities (density, fragility, etc. . . .) was thus made a main element of the rate structure;

(ii) the average minimum road competition according to load; the former highest prices per 10 ton car were lowered by about one third of their value;

(iii) the lower limit in the rate, in relation to the general average marginal cost according to load; the former lowest prices were subject to varied increases according to distance and load, in some cases (rare in any case) up to 100 per cent.

"For consignment shipments, it raised the rates taking into account the particular charges for that service (office work, reception, delivery) and classified the commodities not according to value but to density.

"Finally for rates subject to regulations, the following principles were established:

—separation of rates: each one relates to one given category of facilities;

—principle of surcharge or reduction; . . .

—principle of addition from the application of rates subject to regulations when a transport is subject to a number of rates. . . .

"An important problem remained to be solved: the rate differential according to train services.

"For an equal chargeable distance and the same load, the cost price of transportation varies according to train services.

—On one hand, because the itinerary followed differs more or less from the shortest itinerary.

—On the other hand, because expenditures on the actual itinerary vary according to many factors: stations, classification yards, grade of the line, line equipment, distance covered respectively by local trains and through trains.

"While economically sound with regard to cost price variation from one train service to the other, the idea of rate differential according to train services was also an answer to competition: the best railway lines correspond, because of geography, to the itineraries where road transportation is most advantageous and offers its lowest prices.

"Such is the origin of the 1951 reform which introduced in the rate structure, without modification of form, a systematic differential by train services on high level rates of a general nature, that is directly involved with road competition.

"Based on the fact that in general transportation between two stations costs less for greater cities, the solution to express this differential in rates consisted in preparing a rate index to each station: the sum of the indexes of two stations is the index of train service between those stations; in view of the characteristics of the proportional schedule keyboard used since 1947, it is easy to vary the applicable scale according to the index of train service.

"For the highest rates, the differential between prices on the best train services and the most costly may be about 20 per cent. This differential decreases when the level of rates is lower and, for the lowest rates, the effect of the indexes is nullified.

"This is only an approximative solution (the price is always based on the short distance) and voluntarily limited (the indexes affect only one fifth of the tonnage and one third of receipts from the per car rates).

"The principle is as follows: the cost price being high or low according to lines, it is the same as saying, for the same expenditure, the movement is made over a longer distance on a good line compared to a costly line; this can be translated by giving to each section of a line a certain coefficient, called weighted, by which its metric length is multiplied.

"On the network so weighted, the new distance will be calculated on the weighted short itinerary . . .; this itinerary is in fact most often the one followed."

Description of the Existing Rate Structure

"(a) *Freight Classification of commodities*

Freight is distributed in 700 groups. Each group has a generic destination and covers:

(i) one commodity, *i.e.,* wheat, when the traffic is important;

(ii) or many commodities related by the nature, density, value, etc. . . . (*i.e.,* non-identified grain).

"Also, a given commodity may be classified in two or three different groups according to its packaging (from which depends its loading facilities); *i.e.,* glass in common crates, frames or barrels or, glass otherwise packaged.

"For each generic designation there is a normal condition of tonnage, related to the highest possible load, under normal condition in a 20 ton car. This normal condition is given in the following series in tons.

20—15—12—10—8—7—5—3—2—1.5.

"In other respects the generic designations are in four classes, according to the following relation with their normal condition:

4th class: 20 T and 15 T

3rd class: 12 T and 10 T

2nd class: 8 T and 7 T

1st class: 5 T and less

"(b) *Carload rates*

(i) For each condition of tonnage given in the above series, two rate limits are defined:

—one high (ceiling) taking into account the average level of prices from road competition and represented by a schedule with very little grading;

—one low (floor) in relation to the direct expenditures of railway transportation and represented by a schedule with large grading.

"For a given tonnage, the rates may be quite varied in form and level from one commodity to the other; but they are always included between a floor and a ceiling.

"The [following] table shows, in relation to the floor value 20 T at 25 km used as a unit, the ceiling and floor values by 20 T and 2 T at 25 and 800 km and their ratio.

	20 T		*2 T*	
	25 km	*800 km*	*25 km*	*800 km*
Ceiling	2	20.8	10.2	83
Floor	1	5.2	7.6	41.5
Ratio	2	4.06	1.35	2

(ii) For each generic designation, there is a normal rate in Chapter I of the numbered rates where it is classified.

To the normal rate are added auxiliary . . . rates for less than carload shipments. For a normal load of 15 T for example, there are auxiliary rates for 10, 7 and 5 T.

All rates are in principle proportional between themselves. The difference in price per ton for two conditions of tonnage is related to the respective marginal costs (principle of equality of toll).

As a general rule, the rates in Chapter I have a maximum and a minimum, that is represented by two schedules; those schedules are proportional between themselves. The price ratio is 1.35 for high rates and decreases with the lowering of rates to be 1.10 for the lowest rates.

(iii) For each commodity as justified by the traffic, there are special chapters affected by special conditions and designated for each case.

The special rates apply for a given tonnage, with, as a general rule, only one scale.

(iv) The indexes of train services (the sum of station indexes) range from three to 12. They determine, within the maximum and minimum rate, the applicable schedule for each train service.

"(c) *Rates for small consignments*. Their rates are for shipments:

(i) up to 1000 kg

(ii) for 1000 to 3000 kg in the 1st and 2nd classes and up to 5000 kg in the 3rd and 4th classes.

The rates depend on the classes and the indexes of train services.

"(d) *Parcel post*

The parcels are charged at fixed prices depending on weight and distance. The prices are established on 8 weight division (0-50 kg) and 20 distance zones.

"(e) *Additional rates*. Two particularly new rates:

(i) the possibility of granting directly and with a minimum delay (publication eight days ahead) rate reductions within certain limits between the maximum and minimum rates;

(ii) the possibility of making private agreements with customers, approved by the minister but not published."

Road Competition

Road and Rail Compared

"The comparison of cost prices shows the advantages of rail over road for mass transportation. Total cost prices for the movement of a 20 ton car by rail are less than half the costs of a similar movement in a modern heavy truck." Total cost prices for a train load of coal are about one-quarter what they would be for a similar movement by heavy trucks, leaving aside the calculations of road depreciation involved in such large undertakings.

Fixed schedules, well defined routes with specific points of departure and arrival and the difficult problem of using the facilities to full capacity for certain types of shipments are the main handicaps of the railway.

The freight car is a slave of the train, while the truck can follow a flexible schedule according to the needs of the commodity transported. Terminal costs on the railway must be added to cost prices. The truck moves from the shipping to the delivery points while the railway must supply an additional service equivalent for delivery in Paris to the average cost of 150 km of rail movement.

With regard to speed of service, irrespective of the price charged, the transportation and delivery of a shipment on the same day by a truck, which reduces risks of damages and necessitates less packing, puts the railway at a disadvantage.

With regard to the tonnage carried, trucks with their smaller loads have more flexibility, while rail shipments must be of the order of 10 to 20 tons to take advantage of reduced rates.

One can also imagine the expenditures involved for the use of the railway for shipments of small quantities over short distances compared to the full use of the facilities for bulk shipments.

Road Transport Regulations

From the very beginning of road transportation, the railways of France felt the effect of competition. After World War I, the trucking transportation services were parallel to the most remunerative railway lines. This extraordinary development of road transportation added to service facilities and made them well above the requirements warranted by the prevailing economic conditions.

A first attempt was made in 1934 to provide for transport co-ordination. Machinery was set up for agreements between road and rail transport. Very little was done following this first legislation, except for a slow-down in the growth of truck services. In 1937, the agreements were made mandatory and specific regulations were issued on long-distance truck transportation concerning route, commodities transported and rates, all favouring rail services. But not much had been accomplished when the war came.

The war legislation provided for the elimination of duplicate facilities. In 1946 and more so in 1949, the regulations were modified considerably with an extension of trucking operations, the abandonment of unremunerative railway lines (replaced by truck services at railway rates) and more flexible railway rates. Lack of control impaired the effectiveness of the regulations, and the extension on truck services was looked upon as regressive rather than a step forward with regard to co-ordination.

Measures Taken by the Railway to Defend Itself

The railway in an attempt to consolidate its position adopted or gained the following:

1. flexibility in establishing rates by a reduction in the procedure of rate approvals;
2. adaptation to competition by following closely its cost prices;
3. fixation of a minimum and a maximum price with a range of prices in between. With a more important consideration of the cost price in rate calculations, the value of the commodities, their capacity to support higher rates, the distribution of production areas and the competition of imported products are factors which are still under consideration;

4. special agreements for which rates are not published;
5. other services—speed of trains, door-to-door services, rationalization;
6. agreement between the SNCF and the Fédération nationale des transports routiers to obtain:
   (i) establishment and publication of road rates;
   (ii) professional organization of road transportation agents to supervise tariffs;
   (iii) progressive changes in rates to bring them back to a level of prosperity of the enterprises concerned;
   (iv) harmony of the two rates to achieve equalization between rates and cost prices.

The results of this co-ordination are not known as yet.

Current Outlook

"We think that the solution for the problem can be found by distributing traffic between the two forms of transportation based upon a co-ordinated ratemaking.

"In such a system, the shipper is free to send his traffic to one or the other form of transportation available, taking into account the rates and the advantages they offer. The rates are established at such a level that they provide an incentive for using one form instead of the other; traffic can be directed towards the form of transportation which is considered desirable in the general interest because its cost of production is the lowest. Such rate regulations, by establishing the average level of co-ordinated rates at an acceptable standard, also permit receipts and expenditures to balance and thus eliminate deficits."

References

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Road Transport Regulations
Ibid., pp. 110-121.

Measures Taken by the Railway
Ibid., pp. 92-96 and 121-122.

Current Outlook
Ibid., quote from page 132.